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U. S. DEPARTMENT OF COMMERCE

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U. S. DEPARTMENT OF COMMERCE

OFFICE OF TECHNICAL SERVICES

U. S. Government RESEARCH REPORTS

Vol. 31, No. 6 Pp. 387-509 June 12, 1959

AGRICULTURE

Army Chemical Warfare Labs., Army Chemical Center, Md.
AGE AND PHYSICAL CHARACTERISTICS OF LABORATORY RHESUS MONKEYS (MACACA MULATTA) by Kyle R. Barbehenn and Charles G. Wilber. Oct 58, 15p. 1 ref. CWL Special Pub. 2-9.
Order from LC mi$2.40, ph$3.30 PB 137 964

The purpose of this paper is to describe the physical differences between Old World (including the rhesus) and New World monkeys (used on occasions when rhesus monkeys are unavailable); to describe a simple method of determining the relative age of the individuals; and to describe a simple indirect method for estimating physical condition.

Plant Cultivation

Colorado State U., Fort Collins.
STUDIES ON THE RELATIONSHIP BETWEEN INOCULUM DENSITY AND INFECTION OF WHEAT BY UREDOSPORES OF PUCCINIA GRAMINIS VAR TRITICI, by Lawrence J. Petersen. Technical rept. on Contract N9onr-824(02). May 58, 98p. 51 refs.
Order from LC mi$5.40, ph$15.30 PB 139 550

Uniform, reproducible inoculations were accomplished by means of a spore settling tower. Infection was facilitated by maintaining a temperature of 74 ± 1.5° F. and a relative humidity of 100 per cent in an incubation chamber constructed at the base of the tower. A pure culture of physiologic race 15-B and a mixture of 3 races of uredospores of Puccinia graminis var. tritici were used to inoculate seedlings of Little Club and Marquis wheat, respectively. As a result of these studies conclusions were drawn.

Office of Naval Research, Washington, D. C.
CONFERENCE ON PHOTOSYNTHETIC GAS EXCHANGERS, WASHINGTON, D. C., 11-12 June 56, by Leo A. Shinn. [1956], 99p. ONR Symposium rept. ACR-13; AD-115 117.
Order from LC mi$5.40, ph$15.30 PB 139 549

The purpose was to make a preliminary examination of the feasibility of using the photosynthesis of algae for the simultaneous production of oxygen and removal of carbon dioxide. The conference included presentations and discussions of: (1) nature and scope of the problem, (2) research in photosynthesis pertinent to the solution of the problem, (3) an assessment of photosynthesis as a practical solution, and (4) recommendations for further research.

School of Aviation Medicine, Randolph AFB, Tex.
DESIGN OF AN ALGAL CULTURE CHAMBER ADAPTABLE TO SPACE SHIP CABIN, by James G. Gaume. May 58, 4p. 3 refs. Rept 58-61.
Order from LC mi$1.80, ph$1.80 PB 135 070

This report describes the design of a new type of algal culture chamber apparently capable of utilizing a much smaller amount of power to illuminate a much larger volume of algal suspension, thereby resulting in more efficient utilization of energy. This design could readily be modified, as required, in the establishment of an algal exchange system in a completely closed ecology such as a space ship cabin.

ASTRONOMY

Ohio State U. Research Foundation, Columbus.
INVESTIGATIONS OF STELLAR SCINTILLATION AND THE BEHAVIOR OF TELESCOPIC IMAGES. PART I: STUDIES OF STELLAR SHADOW PATTERNS AND SCINTILLATION, by G. Keller,

W. M. Protheroe, and others. Final rept. on Contract AF 19(604)1409. Dec 56, 154p. 98 refs. AFCRC TR-57-186; AD-117 279.
Order from LC mi$7.50, ph$24.30 PB 139 621

Part I contains a series of papers on the relation of atmospheric turbulence to the formation of stellar shadow patterns and stellar scintillation. The first chapter contains a general account of work done in the field to date. This is followed by a mathematical investigation of the statistical relation between the pattern properties and scintillation, and Chapter 4 gives an account of some pattern characteristics determined from scintillation observations. Chapter 5 describes a specially constructed instrument designed for observing the statistical properties of shadow patterns. Chapter 6 contains observations on the direction and velocity of motion of the shadow pattern, and in Chapter 7 these observations are used to correlate the pattern motion with the motion of air masses at various heights. Part II presents some previously unpublished work on the relation of atmospheric turbulence to the distortion, motion, and internal intensity fluctuations of telescopic images. Chapter 8 contains a bibliography of recent literature on the subject. Chapter 9 is devoted to a mathematical analysis of the combined effects of atmospheric turbulence and optical aberrations on the light distribution in an image (an "image profile"). After the instrumentation is described in Chapter 10, the results of a series of observations made with the Perkins 69-inch reflector are described in Chapter 11. It is concluded that the images produced by this instrument are more seriously affected by thermal distortions of the mirror than they are by atmospheric turbulence. In Chapter 12 an outline of a theory of the internal intensity fluctuations in an image is given, and in Chapter 13 some preliminary observations along these lines are described.

Astrophysics

Carter Observatory (New Zealand).
OBSERVATIONS OF THE AURORA AUSTRALIS: 1930 TO 1954, by L. L. Thomsen, G. W. McQuistan, and B. L. Frankpitt. Scientific rept. no.5 on Contract AF 64(500)4. 31 Mar 56, 294p. AFCRC TN-57-608; AD-133 844.
Order from LC mi$11.10, ph$45.60 PB 138 689

Visual observations of the Aurora Australis collected in New Zealand and adjoining regions over the period 1930 to 1954 are here recorded in a form suitable for further researches. The arrangement of the report has been designed in semi-analytical form which it is hoped will render it more suitable for future work.

Naval Research Lab., Washington, D. C.
SOLAR SPECTRAL INTENSITY MEASUREMENTS (3600A TO 6400A) AT OSKARSHAMN, SWEDEN DURING THE ECLIPSE OF JUNE 30, 1954, by L. Dunkleman, J. D. Purcell, and E. O. Hulburt. Final rept. 31 Dec 58, 14p. 5 refs. NRL rept. 5258; AD-212 530.
Order from LC mi$2.40, ph$3.30 PB 137 017

An experiment to study limb darkening of the sun in the near ultraviolet and visible spectral regions during the solar eclipse of June 30, 1954 was carried out at Oskarshamn, Sweden. The NRL expedition consisted of two groups prepared to study optical limb darkening and radio flux at several wavelengths. The optical apparatus consisted chiefly of four photometers having a dynamic range of 10^8. Eclipse day was overcast. The clouds were not uniform, and optical data obtained could not be interpreted in terms of the spectral brightness of the surface of the sun as a function of distance from the limb. However, the data obtained were useful in obtaining a correlation between optical and radio attenuation. Furthermore, the measurements yielded a curve on the apparent spectral transmittance of clouds.

BEHAVIORAL SCIENCES

Human Engineering

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
MINIMUM ALLOWABLE KNOB CROWDING, by James V. Bradley and Norman E. Stump. Rept. on Control Design and Arrangement. Dec 55, 27p. 9 refs. WADC Technical rept. 55-455.
Order from LC mi$2.70, ph$4.80 PB 138 838

Reach time, turning time and inadvertent touching of adjacent controls were measured while a standard setting was made with one of several closely spaced knobs. Variables manipulated were spacing between knobs, knob diameter and knob configuration. Performance improved rapidly with increasing distance between knob edges up to an interperipheral distance of 1 inch, after which it continued to improve but at a much slower rate. For equal amounts of panel space consumed by several closely crowded knobs, 1/2 inch diameter knobs were more nearly error free than were the larger diameter knobs tested. For equal distances between knob edges, however, performance improved with increasing knob diameter. These results apply only to knobs capable of being operated by moderate torque. Gloves apparently had little effect upon speed of knob operation. It was found that the frequency with which a crowding knob is inadvertently touched is strongly affected by the angular position which it occupies with respect to the operated knob but is practically independent of the presence of other crowding knobs at the same distance from the operated knob.

Air Crew Equipment Lab., Naval Air Material Center, Philadelphia, Pa.
HUMAN ENGINEERING INVESTIGATIONS OF AIRCRAFT COCKPIT VISUAL DISPLAYS: THE CHOICE OF SUBJECTS IN DIAL LEGIBILITY EXPERIMENTS: A METHODOLOGICAL STUDY, by John Gaito. 8 Feb 57, 19p. 3 refs. NAMC-ACEL-316.
Order from LC mi$2.40, ph$3.30 PB 136 724

This study was concerned with investigating the validity of extrapolating results of an experiment based on one population to other populations. A paper and pencil test on aircraft clock designs was administered to experienced naval pilots, to naval non-pilot aircrew personnel, and to naval non-aircrew personnel. Using mean number of errors and mean time per reading as criteria of legibility, the three samples differed in most of the analyses. However, in no case did the relative effectiveness of the various clock designs change from one sample to another. Thus, these results would indicate that generally the findings based on one population may be used in extrapolating to another population.

Applied Psychology Research Unit, Cambridge (Gt. Brit.)
EYE-HAND SPAN IN SIMPLE SERIAL TASK, by E. C. Poulton. 1953, 13p. 6 refs. A.P.U. 158/53; AD-22 169.
Order from LC mi$2.40, ph$3.30 PB 139 278

The normal range of eye-hand span was defined for a 3-choice serial task, and attempts were made to increase and reduce the span in related tasks, in order to discover the factors determining its limits. The normal span was shortest at fast display speeds. As there were 16 alternative responses in the 3-choice task, the length of the span under these conditions depended upon learning which sequences were possible and which were not. An attempt to reduce the span in an 8-response 3-choice task to 0.30 sec. was unsuccessful, it simply produced an increase in errors and omissions. However a comparable method gave a mean response time of only 0.14 sec. in tracking a slow harmonic course. The mean response time was longer and performance more jerky when the course was faster. The normal span was longest at slow display speeds, but was seldom as long as the time interval between display items. It could be increased temporarily by speed stress, although never as far as twice the interval between displays during accurate serial performance. When the span was increased beyond this point by instructions, errors increased, especially with faster speeds of performance. It was concluded that the amount of information required in order to respond was a determinant of the lower limit of the span. The amount of information to be held in store, and the rate of storing and reproducing information, were both determinants of the upper limit.

Applied Psychology Research Unit, Cambridge (Gt. Brit.)
SETTING THE PACE, by R. Conrad. Mar 55, 9p. 2 refs. A.P.U. 232/55; AD-67 765.
Order from LC mi$1.80, ph$1.80 PB 139 280

Two types of forced-paced biomechanical systems are considered: (1) that in which an automatic machine delivers discrete items of work at regular intervals to an operative who processes the items in some way; and (2) that in which an item of work passes from one operative to another, each carrying out one process. Surveys show that some operatives like to be paced, others resent it, and some dislike a pace which is too slow. General considerations of a particular biomechanical system are mathematical as much as psychological. Ignoring the basic characteristics of either human beings or machines leads to inefficient man-machine systems. The nature of the variability inherent in repetitive work is one of the least understood and perhaps most pliable aspects of human behavior.

Institute for Applied Experimental Psychology, Tufts U., Medford, Mass.
HUMAN ENGINEERING BIBLIOGRAPHY, 1956-1957. Rept. on Contract Nonr-494(13). Oct 58, 369p. 1410 refs. ONR rept. ACR-32; AD-205 931.
Order from OTS $5.00 PB 131 507S

Personnel responsible for the human factors considerations in the design and development of equipment have a major need for rapid and easy access to the literature pertinent to their work. The fact that the literature associated with human engineering derives from some 490 different journals and periodicals as well as a host of publications from governmental, industrial, and academic laboratories presents a compelling requirement for the development of useful bibliographic aids. This bibliography is one of a planned series of annual bibliographies of literature pertinent to human engineering which has been designed to meet this requirement. Two major considerations - ease of use and appropriate selection of material - strongly influenced this bibliography. As a result, five main parts exist: (I) a topical outline which defines over 300 topic headings established for this bibliography, (II) an index which associates the approximately 1400 bibliographic entries with the topic headings, (III) an alphabetic index of the common search terms which would aid those using this bibliography but who are unfamiliar with the topic headings, (IV) an annotated bibliography of some 1400 citations, and (V) an index of the authors of these citations.

Martin Co., Baltimore, Md.
EVALUATION OF DECISION MAKING PERFORMANCE ON THREE PICTORIAL NAVIGATION DISPLAYS, by Marshall A. Narva. Rept. on Contract AF 33(616)3749. Nov 58, 49p. 16 refs. WADC Technical rept. 58-49; AD-142 329.
Order from OTS $1.25 PB 151 631

A group of pilots and a group of non-pilots solved two representative types of navigation problems using three map-type navigation displays representing different movement relationships between the aircraft symbol and a ground station symbol. The three displays were as follows: (A) "aircraft movement" display: aircraft symbol translates in x and y and rotates in theta (heading), station symbol (map) is fixed; (B) "mixed movement" display: aircraft symbol fixed in position but rotates in theta, station symbol (map) translates in x and y; (C) "earth movement" display: aircraft symbol is fixed, station symbol (map) translates in x and y and rotates in theta, to indicate change in position and heading. For the non-pilots, there were no significant differences in performance attributable to the different movement relationships. For the pilots, a significant interaction between the displays and the problem types was obtained for two of the measures.

Adjutant General's Office, Washington, D. C.
ABSTRACTS OF PRB RESEARCH PUBLICATIONS-FY 1958, by Arthur J. Drucker and Dorothy L. Barnett. Sep 58, 31p. PRB Technical research note 96.
Order from LC mi$3.00, ph$6.30 PB 137 953

This volume identifies both by publication serial number and by R and D Research Task all research publications prepared and released by the Personnel Research Branch of the Adjutant General's Office in FY 1958. The listing includes 4 Technical Research Reports, 19 Technical Research Notes, 25 Research Memorandums, and 2 Research Studies. Abstracts have been prepared for the majority of FY 1958 publications. Where a publication has been abstracted, the principal research findings have been described in non-technical language as much as possible. Technical language has generally been used as the most expeditious method of communicating details of research design and analysis.

Adjutant General's Office, Washington, D. C.
ANALYSIS OF FLIGHT EVALUATIONS OF HELICOPTER PILOT TRAINEES, by J. Zeidner, H. Martinek, and N. A. Klieger. Apr 58, 21p. 1 ref. PRB Technical research note 93.
Order from LC mi$2.70, ph$4.80 PB 137 972

The major elements entering into the pass-fail decision of 487 trainees were analyzed.

Adjutant General's Office, Washington, D. C.
PREDICTION OF ENLISTED PERFORMANCE UNDER CONDITIONS OF EXTREME COLD, by Louis P. Willemin, John E. de Jung, and Aaron Katz. Sep 58, 18p. 7 refs. PRB Technical research rept. 1113.
Order from LC mi$2.40, ph$3.30 PB 137 899

Tests comprising the Army Classification Battery, the 1955 and the 1958 combat aptitude area composites, Form 20 test scores and background information, some experimental tests, and other background data were validated against a criterion obtained by HumRRO in cold weather maneuvers. The criterion was based on rankings by tentmates on the desirability of having the EM along on another similar maneuver. Three criterion groups were formed from the rankings--a "higher" group of 32 men, a "middle" group of 18, and a "low" group of 32. The new combat aptitude area composites had superior validity over that of the old combat aptitude area composites for cold weather performance. An Arctic self-description device also showed considerable validity, although none of the coefficients was as high as those obtained in the original validation of these instruments in combat and garrison-maneuvers.

Adjutant General's Office, Washington, D. C.
PREDICTION OF SUCCESS IN ADMINISTRATION AND MACHINE ACCOUNTING JOBS, by L. H. Sharp, W. H. Helme, and R. F. Boldt. June 58, 21p. 3 refs. PRB Technical research note 94.
Order from LC mi$2.70, ph$4.80 PB 137 781

The general level of prediction provided by use of these aptitude area composites was about as high as could be reasonably expected in a job prediction study. Aptitude Areas CL and GT showed about equal predictive promise for five of the jobs; Aptitude Area GT indicated somewhat better predictive potential for the remaining two jobs. Since Aptitude Area CL is a shortage area, these findings constitute support for the substitution of GT as the selector for Personnel Specialist (Adm) and Personnel Specialist (Mgmt), and suggest the use of GT also for jobs of Administrative Specialist, Personnel Accounting Specialist, and Machine Accounting Specialist, providing it is feasible to make such a change.

Adjutant General's Office, Washington, D. C.
PREDICTION OF SUCCESS IN SELECTED ELECTRONICS REPAIR JOBS, by L. H. Sharp, W. H. Helme, and R. K. White. Apr 58, 18p. 6 refs. PRB Technical research note 92.
Order from LC mi$2.40, ph$3.30 PB 137 971

The validity of three predesignated Aptitude Area composites (the current Aptitude Area and two logical alternates) was determined for 73 Fire Control Equipment Repairmen, 184 Fixed Station Receiver, 178 Teletypewriter Repairmen and 136 Powermen. Even though the general level of prediction was lower than expected in a job prediction study, the validity evidence, when viewed along with previous course results and when compared with validity of the course grades themselves, indicated the Electronic Aptitude Area to be the best available selector for four of the five jobs and the Motor Maintenance Aptitude Area to be best for the job of Powerman.

Adjutant General's Office, Washington, D. C.
VALIDATION OF EXPERIMENTAL SELF-DESCRIPTION MATERIALS FOR GENERAL AND DIFFERENTIAL CLASSIFICATION, by C. D. Johnson and Leo J. Kotula. Aug 58, 19p. 12 refs. PRB Technical research note 95.
Order from LC mi$2.40, ph$3.30 PB 137 973

From test materials and test data developed and collected from a long-range program of research, eleven special personality measures relating to general and special job performance requirements of cooks, clerks, and mechanics were constructed.

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
EFFECTS OF A CHANGED ENVIRONMENTAL CONTEXT UPON PERFORMANCE OF A TRACKING TASK, by Ross L. Morgan and Gordon A. Eckstrand. Rept. on Learning and Transfer in Reference to Training Device Design. Oct 53, 25p. 11 refs. WADC Technical rept. 53-235; AD-25 503.
Order from LC mi$2.70, ph$4.80 PB 135 725

The use of synthetic training equipment saves opera-

tional equipment and personnel. However, the availability of such equipment is influenced by its cost. This report represents an attempt to determine the training value of certain components which contribute to the cost of some synthetic training devices. Two groups, 20 male subjects each, were required to perform a two-dimensional tracking task in a complex situation (enclosed cockpit, red panel lights, helmet, engine noise, vibration, etc.). Both groups had practiced the task one week earlier; however, one group had practiced in the complex situation while the other group had practiced in a more simple situation (open cockpit, ambient illumination, no helmet, no noise, no vibration, etc.).

Air Force Personnel and Training Research Center, Lackland AFB, Tex.
DESIGN AND USE OF JOB AIDS FOR COMMUNICATING TECHNICAL INFORMATION, by Arthur J. Hoehn and Arthur A. Lumsdaine. Jan 58, 42p. AFPTRC TR-58-7; AD-152 109.
Order from LC mi$3.30, ph$7.80 PB 134 615

Preliminary techniques for the systematic planning, development, and testing of a method for developing an integrated job-aid and training materials package were outlined.

Air Force Personnel and Training Research Center, Lackland AFB, Tex.
INDEX TO AIR FORCE PERSONNEL AND TRAINING RESEARCH CENTER 1956 TECHNICAL DOCUMENTARY REPORTS. Dec 56, 29p. AFPTRC TN-56-140; AD-98 916.
Order from LC mi$2.70, ph$4.80 PB 138 232

Technical documentary reports released in 1956 by the Air Force Personnel and Training Research Center are identified in this Index by publication serial numbers. The serial listing includes 141 Technical Notes and Technical Reports as defined by the Air Research and Development Command, as well as two reports from former contracts of the Human Resources Research Institute. For the convenience of users of this Index, the cross-reference listings by author, laboratory, and project number are keyed to the numbers in the Serial Listing of Technical Documentary Reports on pages 6-18. Inasmuch as the reorganization of the Center, effective 1 May 1956, abolished some units and renamed others, the original designations of the responsible agencies have been retained.

Air Force Personnel and Training Research Center, Lackland AFB, Tex.
RESEARCH INTO BASIC METHODS AND TECHNIQUES OF AIR FORCE JOB ANALYSIS-III, by Jesse C. Rupe and Risdon J. Westen. Dec 55, 76p. 11 refs. AFPTRC TN-55-53.
Order from LC mi$4.50, ph$12.30 PB 137 514

The present report, describes the application of five techniques of job analysis to a block of four Air Force jobs two of which were simple and two complex.

Air Force Personnel and Training Research Center, Lackland AFB, Tex.
A TECHNIQUE OF JOB ACTIVITY DESCRIPTION FOR NEW WEAPON SYSTEMS: TASK EQUIPMENT ANALYSIS, by James T. Ray, George E. Passey and others. Dec 57, 73p. 6 refs. AFPTRC TR-57-13; AD 146 419
Order from LC mi$4.50, ph$12.30 PB 137 401

This report describes work done which produced one feasible procedure for preparing position-oriented, behavioral descriptions of job tasks-the task-equipment analysis (TEA). This technique resulted from a logical analysis of the problem and experience in developing prototype TEAs for three maintenance positions for the C-130A aircraft. The recommended procedure is described in detail with examples. A cross-index of equipment components and job duties is included.

American Institute for Research, Pittsburgh, Pa.
DEVELOPMENT OF A TEST BATTERY FOR STUDY OF AGE-RELATED CHANGES IN INTELLECTUAL AND PERCEPTUAL ABILITIES, by Murray Glanzer, Robert Glaser, and Milton Richlin. Mar 58, 24p. 37 refs. AFSAM rept. 56-138.
Order from LC mi$2.70, ph$4.80 PB 135 068

A battery was constructed to measure age-related changes in behavior relevant to skilled performance of Air Force officers. The battery was administered to 544 flying officers. Of the 14 tests in the battery the scores on 8 indicated significant decrease with age. The size of the correlation coefficients, ranging between -.11 and -.33, did not, however, indicate major losses with age. It is suggested that more pronounced declines with age reported in previous studies may be the result of the use of tests that are not relevant to the life activities of the population tested.

Human Resources Research Office, George Washington U., Washington, D. C.
FIGHTER I: AN ANALYSIS OF COMBAT FIGHTERS AND NON-FIGHTERS, by Robert L. Egbert, Tor Meeland and others. Technical rept. no. 44 on Contract DA 44-109-qm-650. Dec 57, 70p. 6 refs.
Order from LC mi$3.90, ph$10.80 PB 136 218

The purpose of this study was to identify the characteristics which differentiate very good combat performers (fighters) from very poor combat performers (non-fighters). Knowledge of these characteristics can be used in the development of experimental procedures for training, and also for selection and organization of fighting units. The sample of 310 front-line soldiers in Korea was chosen for psychological testing on the basis of information about their recent combat behavior furnished by their peers and by themselves. The findings report the differences between fighters and non-fighters revealed by the test scores.

Naval Personnel Research Field Activity, San Diego, Calif.
THE DEVELOPMENT AND STANDARDIZATION OF FORM 6 OF THE NAVY ARITHMETIC TEST, by Bernard Rimland. Aug 58, 22p. 6 refs. BuPers Tech-

nical Bulletin 58-5.
Order from LC mi$2.70, ph$4.80 PB 137 826

Form 6 of the U.S. Navy Arithmetic Test was developed and is suitable for operational use.

Naval Personnel Research Field Activity, San Diego, Calif.
THE DEVELOPMENT AND STANDARDIZATION OF FORM 6 OF THE NAVY GENERAL CLASSIFICATION TEST, by Bernard Rimland. Aug 58, 18p. 2 refs. BuPers Technical Bulletin 58-4.
Order from LC mi$2.40, ph$3.30 PB 137 827

The development of Form 6 of the General Classification Test was undertaken. GCT Form 6 appears to be an improvement on the previous GCT forms in all presently measurable respects, and may be substituted for them.

Naval Personnel Research Field Activity, San Diego, Calif.
THE DEVELOPMENT AND STANDARDIZATION OF FORM 6 OF THE NAVY MECHANICAL TEST, by Leonard Swanson. Aug 58, 19p. 1 ref. BuPers Technical Bulletin 58-6.
Order from LC mi$2.40, ph$3.30 PB 137 825

The purpose was to develop a new form of the mechanical Test (MECH 6) for the Navy Enlisted Basic Test Battery (BTB) in order to minimize the loss in effectiveness through possible compromise and to improve the use of the MECH test for differential classification by reducing the correlations with the other tests in the battery.

Naval Personnel Research Field Activity, San Diego, Calif.
THE MODIFICATION OF BASIC SIGNALMAN TRAINING FOR OPTIMUM UTILIZATION OF AN AUTOMATIC CODE KEYER, by Edward J. Pickering and Herman Roemmich. May 58, 76p. 30 refs. BuPers Technical Bulletin 58-3.
Order from LC mi$4.50, ph$12.30 PB 137 183

This report describes the combined efforts of training research and operational training personnel in developing a program for the training of signalman. The specific purposes of the project were to (a) introduce into the Basic Signalman Course, Fleet Training Center, San Diego, a device designed to send visual code signals automatically, and (b) develop a course of instruction which would make optimum use of such a device. The major developments included (1) design of a course and methods for applying results of previous research on code learning, (2) development of a suitable training aid and appraisal of available devices, (3) revision of the course after empirical evaluation, and (4) determining the improvements made through statistical analysis of results.

Naval Personnel Research Field Activity, San Diego, Calif.
VALIDITY OF AN EXPERIMENTAL UNDERWATER DEMOLITION TEAM SELECTION BATTERY FOR AN OFFICER SAMPLE, by Edward F. Alf and Leonard V. Gordon. Apr 58, 10p. 5 refs. BuPers Technical Bulletin 58-7.
Order from LC mi$1.80, ph$1.80 PB 137 970

The present report describes the validity of an experimental selection battery for 55 officers and compares the results of the officer and enlisted groups.

Naval Research Lab., Washington, D. C.
THE USE OF "ARTIFICIAL SIGNALS" TO ENHANCE MONITORING PERFORMANCE, by W. D. Garvey, F. V. Taylor, and E. P. Newlin. Interim rept. 16 Feb 59, 9p. 10 refs. NRL rept. 5269.
Order from LC mi$1.80, ph$1.80 PB 137 018

Five experiments were run in which subjects monitored a display for signals occurring on one or another of several dials over a 2-hour period. The purpose of the experiments was to determine the effect of frequently inserting "artificial" signals on the detection of infrequently occurring "real" signals. In addition, it was sought to determine the value of giving the subjects informative and motivational feedback relative to their efficiency in the detection of the artificial signals. The results indicated that the addition of artificial signals enhanced markedly the subjects' proficiency in monitoring infrequently appearing real signals. Informative and motivational feedback relative to performance on the artificial signals produced additional small but reliable improvements in the detection of real signals.

Personnel Lab., Lackland AFB, Tex.
APTITUDE DIFFERENCES RELATED TO REGION OF ENLISTMENT OF BASIC AIRMEN, by C. A. Thompson. Sep 58, 21p. 4 refs. WADC TN-58-65; AD-202 846.
Order from LC mi$2.70, ph$4.80 PB 137 800

Regional differences in mean performance on aptitude variables were found with basic airman samples tested in 1950 and 1953. This study examines trends in over-all regional differences for a 1957 basic airman sample. Regional differences on specific variables are examined in terms of AFQT mental category. The sample was 4,447 basic airmen processed at Lackland Air Force Base in September and October 1957. Geographical regions are Army areas of enlistment and the territories. The variables are the Armed Forces Qualification Test, the five Airman Classification Battery Aptitude Indexes (AC-2A), and the individual tests of the Airman Classification Battery. Major regional differences in mean performance of the 1957 basic airman sample were consistent with regional differences reported for 1950 and 1953 samples. Low aptitude airmen made the principal contribution to over-all regional differences on specific aptitude variables. High aptitude airmen tended to exhibit slight differential mean performance by geographical region. The territorial sample's performance was atypical of the performance of continental samples.

Personnel Lab., Lackland AFB, Tex.
APTITUDE LEVELS IN THE ENLISTED MANPOWER POOL OF THE AIR FORCE, PART I, by Jane McReynolds. Sep 58, 34p. 1 ref. WADC TN-58-63(1); AD-151 047.
Order from LC mi$3.00, ph$6.30 PB 137 116

Rapid development of weapon systems has increased the need for highly qualified airmen in technical areas and for information concerning their availability. This is the first in a series of reports designed to provide estimates of the aptitude levels of enlisted personnel in the Air Force. From data collected in the May 1957 Sample Survey, distributions of aptitudes were obtained by career fields, by reenlistment plans, by term of enlistment, by skill level, and by grade. Distributions are presented in terms of the total Air Force enlisted population so that estimates can be made not only of the numbers of airmen of each aptitude level in any one group, but of the numbers in any other group who have aptitude levels high enough to permit efficient retraining into shortage areas. For airmen in their first term of enlistment, aptitude distributions were typically the normal bell shape with little difference in level between career fields. Airmen in later enlistments were typically higher in aptitude; methods of screening for reenlistment and for promotion build up the quality of career personnel so that the majority of NCOs, and especially those in the highly technical career fields, have high aptitude qualifications and are capable of supporting modern technological advances.

Personnel Lab., Lackland AFB, Tex.
DEVELOPMENT OF THE AIRMAN QUALIFYING EXAMINATION, FORMS D AND E, PART I, by C. A. Thompson. Aug 58, 20p. 4 refs. WADC TR-58-94 (1); AD-151 045.
Order from LC mi$2.40, ph$3.30 PB 137 799

Forms D and E of the Airman Qualifying Examination were developed for field use in obtaining a set of aptitude indexes equivalent to indexes of the Airman Classification Battery. They were designed for administration at a single testing session and for hand scoring. Four aptitude indexes are obtained with the instruments: Mechanical, Administrative, General, and Electronics. The item types used in the AQE indexes conform insofar as possible to the item types of the Airman Classification Battery, AC-2A. Each AQE index is standardized on the corresponding AC-2A index and uses the same form of converted index, a 20-step percentile scale. For administrative purposes the AQE and ACB indexes have been used interchangeably in determining personnel actions. The AQE and ACB have shown themselves substantially equivalent with one exception. When AQE is administered to a group before they receive the ACB, their AQE scores tend to be lower. The practical importance of this difference will vary with the use of the instruments.

Personnel Lab., Lackland AFB, Tex.
DISCRIMINANT ANALYSIS AND ITS ROLE IN THE CLASSIFICATION OF AIRMEN, by John A. Creager. Nov 57, 28p. 44 refs. AFPTRC TN-57-127; AD-134 259.
Order from LC mi$2.70, ph$4.80 PB 135 901

The basic issues of discriminant analysis, methodology, and applications are reviewed critically from the viewpoint of potential application to the selection and classification of airmen. Relations among discriminant, regression, and allocation models are discussed. While the basic issues and methods of discriminant analysis are simple in principle, development leading to operational utility in airman assignment decision is complicated by effects of prior allocation. Further research should be concentrated on the problem of developing appropriate criteria for defining groups to be discriminated, and to clustering of jobs in terms of the ability of the classification battery to make discriminations.

Personnel Lab., Lackland AFB, Tex.
THE EDUCATIONAL ACHIEVEMENT OF AIR FORCE OFFICERS, by Ernest C. Tupes and Donald B. DuBois. Nov 58 [41]p. 12 refs. WADC-TN-58-68; AD-205 546.
Order from OTS $1.25 PB 151 668

Do years of formal education truly measure an Air Force officer's educational achievement? Do many officers have more knowledge than would be expected from the number of years they spent in school? To answer these questions, 1300 student officers at Air University were given the Area tests and an Advanced test of the Graduate Record Examination. The results indicate that years of education is not very predictive of actual educational achievement and usually underestimates it. As a group, officers were found to have learned more than would be expected from their years of education. Although only 40% of the officers had college degrees, between 50% and 60% scored as high on the Area tests as satisfactory college graduates. On the Advanced tests, which measure intensive knowledge in specialized academic major fields, the officers who lacked the educational requirements for Air Force training courses had as much of the specialized knowledge needed for enrollment in such courses as did officers with the prerequisite educational backgrounds. Were entrance requirements for these courses altered to permit qualification on a test basis, the number of officers eligible for such training would be greatly increased.

Personnel Lab., Lackland AFB, Tex.
FACTORS IN FIGHTER-INTERCEPTOR PILOT COMBAT EFFECTIVENESS, by E. Paul Torrance, Carl H. Rush., Jr. and others. Nov 57, 41p. 15 refs. AFPTRC TR-57-11; AD-146 407.
Order from LC mi$3.30, ph$7.80 PB 138 239

This study was undertaken to determine why some pilots were more successful in air-to-air combat over Korea than other pilots of similar backgrounds. The first phase involved analysis of officially recorded data on 749 F-86 pilots with combat tours in Korea. The second phase consisted primarily of comparisons of 31 aces (5 or more kills) with nonaces matched for rank, age, and whether or not they had been pilots in World War II on variables derived from interviews, life experience inventories, Rorschachs, and other psychological data.

Personnel Lab., Lackland AFB, Tex.
THE RELATION OF SELECTIVE APTITUDE INDEX TO PERFORMANCE IN TECHNICAL SCHOOL, by C. A. Thompson. Nov 58 [15]p. WADC-TN-58-67; AD-205 365.
Order from OTS $0.50 PB 151 667

The effectiveness of the Airman Classification Battery (Form AC-2A) in predicting success in airman technical school courses is examined. The population consisted of airmen enlisted during the first three months of 1956 and assigned to 10 groups of technical schools after basic training. The relationships of the aptitude index used for selection with final school grades are depicted in 11 charts. The selective aptitude index was predictive of class standing in all courses, the strongest relationships obtaining for the highly technical courses. During this period a majority of the airmen assigned to the highly technical courses did not meet the recommended selective aptitude index minimums recommended by the Air Force.

Personnel Lab., Lackland AFB, Tex.
RELATIONSHIPS BETWEEN AIRMAN INTERESTS AND CAREER SATISFACTIONS, by Frances M. Carp (Trinity U.). Mar 26p. 17 refs. WADC TR-58-90; AD-151 038.
Order from LC mi$2.70, ph$4.80 PB 137 133

This study is an attempt to validate a 264-item interest inventory for inclusion in the basic airman battery to improve prediction of general competence in the Air Force situation and in particular Air Force jobs. Assuming that satisfaction is related to effectiveness in a work situation, it was taken as the criterion for this study. Responses of 842 airmen were validated against their answers to Sample Survey questions selected as indexes of satisfaction with the general Air Force situation and with particular Air Force duty. Predictive validity was not demonstrated for existing keys with general Air Force personnel or selected job specialty groups; item analysis did not result in new scales.

Quartermaster Field Evaluation Agency, Fort Lee, Va.
A PSYCHOLOGICAL TECHNIQUE FOR SELECTION OF PERSONNEL TO PERFORM AS OBSERVER-RECORDERS IN FIELD TESTS, by Robert S. Andrews. Oct 58, 39p. 18 refs. Technical rept. R-3; FEA MRS 5801.
Order from LC mi$3.00, ph$6.30 PB 137 888

The Lowry Reasoning Test was investigated. The Lowry Reasoning Subtest A was found to be the most discriminative and effective selection device of those investigated. Computation of various multiple correlations provided only negligible improvement over this single test. The prediction equation based on the Lowry Reasoning Subtest A was formulated and furnished a useful technique for predicting probable observer-recorder performance. Its application to the test data from the experimental group permitted identification of a minimum of 49 men who would be expected to perform satisfactorily as opposed to only 7 from whom adequate performance would be expected using the previous criterion of level of education. Implications for future research are discussed.

School of Aviation Medicine, Randolph AFB, Tex.
SYMPOSIUM ON PHYSICAL STANDARDS AND SELECTION, AVIATION MEDICINE RESIDENCY TRAINING PROGRAM, 19-20 FEB 57. Annual Resident's Symposium on Aviation Medicine no. 3. [1957] 154p. 44 refs.
Order from LC mi$7.50, ph$24.80 PB 139 477

Teachers Coll., Columbia U., New York.
LONG-TERM PREDICTION OF SOME OFFICER-EFFECTIVENESS MEASURES FROM APTITUDE TESTS, by R. L. Thorndike and Elizabeth P. Hagen. Rept. on Contract AF 41(657)10. Oct 58, 37p. 3 refs. WADC TR-58-489; AD-204 531.
Order from OTS $1.00 PB 151 675

Aptitude tests administered to applicants for flying training in 1943 were correlated with selected indicators of achievement during the following 12 years for 873 Air Force officers. Criterion components identified were: (1) effectiveness as perceived by superiors; (2) quality and quantity of flying duty; (3) importance of duty assignments; and (4) continuity of service. The first component was predicted, but only to a slight degree, by tests of intellectual and academic ability. Tests of mechanical ability and of motor coordination were slightly predictive of the second and third components. The fourth component was largely unpredicted. Any success in identifying men who would receive high officer effectiveness ratings came from measures of quantitative and intellectual abilities and not from the tests that predict success in flying training.

Psychology

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
ACOUSTIC NOISE AND REPEATED TIME JUDGMENTS IN A VISUAL MOVEMENT PROJECTION TASK, by Harry J. Jerison; Clarke W. Crannell and Dorothy Pownall (Miami U., Rept. on Operator Performance in High Energy Noise Fields, Contract AF 33(616)2844. Mar 57, 31p. 12 refs. WADC Technical rept. 57-54; AD-118 004.
Order from LC mi$3.00, ph$6.30 PB 135 915

Two hundred volunteer male students, working individually, were required to follow a moving target visually and to imagine the continuing movement of the target after it disappeared. When the target was believed to have reached a crosshair the subject squeezed a trigger. The task, which simulates radar observation of a target obscured by visual noise, was repeated ten times. The effect of different acoustic noise programs on the accuracy of judgment was assessed, and the independence of successive judgments was determined. The performance measure was judgment time, the interval between the disappearance of the target and the subject's response. It was found that a noise program in which it was quiet (78 db) during the visible portion of the target's course and noisy (110 db) when the target disappeared gave longer judgment times relative to those obtained under control conditions of quiet or noise throughout. The opposite program of

"noise then quiet" was not differentiated from the control conditions. It was also found that judgment times became longer in succeeding trials under all four noise programs.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
ORDERED METRIC MODEL OF INDIVIDUAL CHOICE BEHAVIOR, by Robert F. Fagot. Technical rept. no. 13 on Contract Nonr-225(17). 12 Sep 57, 49p. 12 refs.
Order from LC mi$3.30, ph$7.80 PB 135 924

The purpose of this paper is to present a model of individual choice behavior which leads to an ordered metric scale of subjective value, or utility. The model has the feature that it is possible to derive from it "weaker" alternative models which can be compared in experimental situations.

Army Medical Research Lab., Fort Knox, Ky.
DIFFERENCES IN RESPONSE LATENCY WITH DIFFERENT MAGNITUDE ANGULAR ACCELERATION, by F. E. Guedry and G. Richmond. Rept. on Psychophysiological Interaction Problems. 2 Nov 57, 11p. 7 refs. Rept. no. 301.
Order from LC mi$2.40, ph$3.30 PB 138 230

Fifteen subjects received a series of 8 angular accelerations during each of 5 sessions. They were required to signal onset of apparent rotation as quickly as possible. The interval between onset of acceleration and the subject's signal of apparent rotation, termed response latency, bears an inverse relationship to magnitude of angular acceleration. This relationship appears very systematic in all subjects in spite of fairly large differences between some individuals in the magnitude of their responses. Discrepancies between the obtained results and predictions, derived from theoretical mechanics of the semicircular canals, are discussed.

Army Medical Research Lab., Fort Knox, Ky.
HEAT REINFORCED OPERANT BEHAVIOR AS A FUNCTION OF PROLONGED COLD EXPOSURE, by P. L. Carlton, R. A. Marks, and B. Smith. Rept. on Climatic Effects on Psychophysiological Abilities. 13 Jan 58, 12p. 4 refs. Rept. no. 325.
Order from LC mi$2.40, ph$3.30 PB 137 130

White rats working at a low ambient temperature were trained to depress a lever to receive brief periods of heat as the reinforcement. When their response rate had stabilized, the animals' living cages were moved into a 2° C environment. The effects of this continual cold exposure were increases in both lever pressing and food intake, and a loss in body weight.

Army Medical Research Lab., Fort Knox, Ky.
PERCEIVED FRONTAL SIZE AS A DETERMINER OF PERCEIVED STEREOSCOPIC DEPTH, by W. C. Gogel and J. A. Schneps. Rept. on Relation between Optical Aids and Perception in Visual Observation. 3 Sep 57, 23p. 5 refs. Rept. no. 296.
Order from LC mi$2.70, ph$4.80 PB 137 003

This study was concerned with the process by which a stereopsis extent is perceived as a linear depth extent. In an experiment involving different frontal sizes of the same familiar object, the perceived depth resulting from a stereopsis extent increased as the retinal size of the familiar objects decreased. This result cannot be explained by a change in the perceived absolute distance of the familiar objects. An equation was developed for predicting the apparent depth extent associated with a stereopsis extent as a function of (1) an observer constant and (2) the ratio of the perceived to the retinal size of frontal extents in the vicinity of the stereopsis.

Army Medical Research Lab., Fort Knox, Ky.
RESPONSE REVERSAL AND FATIGUE, by Edwin G. Aiken. Rept. on Climatic Effects on Psychophysiological Abilities. 28 June 57, 18p. 17 refs. Rept. no. 289.
Order from LC mi$2.40, ph$3.30 PB 136 858

A fatigue inducing training procedure was found to interfere with the acquisition of two successive, incompatible tasks. The relationship held for both speed and accuracy measures. Psychological blocking was shown to be a sensitive and independent measure of fatigue effects.

Connecticut Coll., New London.
PSYCHOLOGICAL STRESS AND RELATED CONCEPTS: A BIBLIOGRAPHY, by Mortimer H. Applezweig. Technical rept. no. 7 on Motivation Research Proj., Contract Nonr-996(02). Dec 57, 185p. 2611 refs.
Order from LC mi$8.40, ph$28.80 PB 138 221

Connecticut U., Storrs.
MEASUREMENT OF NON-INTELLECTUAL ASPECTS OF INTELLIGENCE, by Walter A. Kaess, Sam L. Witryol, and Joseph J. Danick. Final rept. on Contract Nonr-1886(00). 30 Sep 57, 16p. 6 refs.
Order from LC mi$2.40, ph$3.30 PB 135 891

This summary, together with appropriate references to relevant technical reports, presents a brief account of progress. Most of the data are based upon college subjects at the University of Connecticut.

[Institute of Applied Psychology] U. of Maryland, College Park.
EFFECTS OF TWO TYPES OF STRESS AND ANXIETY ON PERFORMANCE OF A PERCEPTUAL TASK, by W. Z. Davidson. Technical rept. no. 6 on Indicators of Behavior Decrement, Contract DA 49-007-md-222. 31 Aug 53, 49p. 30 refs.
Order from LC mi$3.30, ph$7.80 PB 139 619

This study was designed to determine the effects of two types of stress and manifest anxiety on performance of a perceptual task. The two types of stress used were task induced stress and failure stress. The perceptual task was repetitive color naming at high speed. The results indicate that task induced stress conditions exhibit a positive relationship with perform-

ance as measured by errors of omission; whereas, failure stress conditions exhibit a curvilinear but generally increasing relationship with performance. Anxiety appears to increase susceptibility to the effects of stressful conditions.

Personnel Lab., Lackland AFB, Tex.
APPLICATION OF HOMOGENEOUS KEYING TO SPATIAL RELATION ITEMS, by Milton A. Whitcomb. July 57, 35p. 22 refs. Research rept. no AFPTRC TN-57-91; AD-134 211.
Order from LC mi$3.00, ph$6.30 PB 139 289

The study was designed to determine the feasibility of applying the Gleser-Loevinger-BuBois technique of homogeneous keying to an aptitude area. The area chosen, spatial relations, is of current interest to the Air Force, since airman-level tests of a perceptual nature are needed in the Airman Classification Battery. Homogeneous keying techniques were applied to a group of 180 spatial test items selected with intent to sample existing items in the spatial relations area. The subjects consisted of 1000 basic airmen. The resultant keys (tests) were checked for stability of their reliabilities and intercorrelations on an independent sample of 500 basic airmen. The method appears to be valuable when applied to an aptitude area. Though the method furnishes much the same information as that gained from a factor analysis of an aptitude area, it has the advantage that the product of the method is a set of independent tests ready to be used rather than a set of factors with many tests having varying loadings on them. However, the pool of items selected for keying determines both the number and the homogeneity of the resultant tests. Therefore care should be taken in determining the range of item variety, equalizing the number of items of each item-type, and limiting the range of item-difficulty levels so that the tests produced will be closely tailored to the need of the requesting agency.

Personnel Lab., Lackland AFB, Tex.
DEVELOPMENT OF AN ACTIVITY PREFERENCE TEST, by Truman L. Kelley. July 57, 51p. 5 refs. AFPTRC TN-57-107; AD-134 228.
Order from LC mi$3.60, ph$9.30 PB 136 706

The Activity Preference Test has four sections of exercises with alternate forms for all but the first section. The first section asks for biographical information as remembered at age 13½; the second section asks for activity preferences as remembered at age 13½; the third section asks for present preferences; and the fourth section asks for presumed preferences at age 45. It was revised to make it suitable for the airman age range and for both men and women. The revised form was administered to seven groups of men and two groups of women. Component scoring procedures previously developed were applied, and component scores were analyzed for reliability and group differences. For a sample of 100 airmen, a second set of component scores was derived to compare a simplified scoring method with the original procedure. A chart form was developed for profiling individual and group component scores.

School of Aviation Medicine, Randolph AFB, Tex.
ADAPTATION OF THE MMPI FOR AEROMEDICAL PRACTICE NORMS FOR MILITARY PILOTS, by Samuel C. Fulkerson and Saul B. Sells. Dec 58, 7p. 6 refs. Rept. 58-128.
Order from LC mi$1.80, ph$1.80 PB 137 967

New norms for the Minnesota Multiphasic Personality Inventory (MMPI) are presented which were derived from a sample of military pilots. The need for special norms for military pilots, the derivation of the norms, and suggestions for their use in aeromedical practice are presented.

School of Aviation Medicine, Randolph Air Force Base, Tex.
PRESERVICE PERSONALITY PROBLEMS AND SUBSEQUENT ADJUSTMENTS TO MILITARY SERVICE: PREDICTION OF PSYCHONEUROTIC REACTIONS, by Merrill Roff. (Inst. of Child Welfare) Nov 57, 12p. 5 refs. Rept. 57-136.
Order from LC mi$2.40, ph$3.30 PB 135 492

A longitudinal follow-up study is being made of patients of public school child guidance clinics and a nonpatient control group through subsequent military service. The present report compares two groups of former patients of the child guidance clinics: one group (55 men) were diagnosed as neurotic while in service; the other group of 55 represent individuals who attained a grade of sergeant or higher with no adverse indications in their military records. Childhood tendencies to antagonize others to an unusual degree were shown to distinguish the potential neurotic with a high degree of accuracy.

School of Aviation Medicine, Randolph [AFB] Tex.
PSYCHOLOGICAL ADAPTABILITY: STANDARDIZATION OF A PSYCHOMOTOR TEST AND CONSIDERATION OF TRANSFER EFFECTS, by George T. Hauty. Jan 53, 21p. 27 refs. Proj. no. 21-0202-0005, rept. no. 2.
Order from LC mi$2.70, ph$4.80 PB 135 472

Yale U., New Haven, Conn.
SHOULD GROUP OR INDIVIDUAL WORK COME FIRST ON PROBLEMS REQUIRING CREATIVE THINKING WHEN EQUAL TIME IS DEVOTED TO EACH? by Donald W. Taylor and Clifford H. Block. Technical rept. 2 on Contract Nonr-609(20). Dec 57, 35p. 5 refs.
Order from LC mi$3.00, ph$6.30 PB 138 080

The data obtained failed to provide a clear-cut answer to the primary question under investigation. On the basis of the present experiment, the answer to the primary question must at least tentatively be: No evidence is available that it makes any difference in number of ideas produced whether group or individual work comes first. One conclusion, however, can be rigorously drawn: When members of a group devote equal time to working alone and in a group, more ideas are produced when working alone regardless of whether group or individual work come first. Should group or individual work come first on problems re-

quiring creative thinking when equal time is devoted to each? The conclusion previously stated may now be amended to read: No evidence is available that it makes any difference in number of ideas produced, whether group or individual work comes first.

BIOLOGICAL SCIENCES

Millipore Filter Corp., Watertown, Mass.
THE PRODUCTION OF MEMBRANE FILTERS OF GRADED POROSITY. Monthly progress rept. nos. 1-14 and Final rept. for 1 July 54-31 Dec 55. 15 nos. in 1v. 248p. 125 refs.
Order from LC mi$11.10, ph$37.80 PB 138 887

The studies undertaken in this research have been directed toward the development of processes for producing three new basic types of membrane filters having the following pore size and filtration characteristics: (1) Virus type - pore size 10 to 100 millimicrons, retaining particles in size range from 10 to 100 millimicrons. (2) 2-D type - showing absolute retention on a surface plane of bacteria larger than 3 microns in minimum dimension. (3) Coarse type - having a pore size of 5 microns.

Syracuse U., N. Y.
NUTRITIVE VALUE OF THE WOOD-ROTTING FUNGI AND THEIR SYNTHETIC PRODUCTS, by M. W. Jennison, Chester Koda and others. Rept. no. 7 (Final) 1 Oct 52-30 Sep 57, Contract Nonr-669(06). Nov 57, 31p. 19 refs.
Order from LC mi$3.00, ph$6.30 PB 137 140

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Anatomy and Physiology

Air Force Missile Development Center, Holloman AFB, N. Mex.
PHYSIOLOGY OF LAUNCHING AND RE-ENTRY STRESS IN RODENTS, by Harald J. vonBeckh. Aug 58, 12p. 10 refs. AFMDC TN-58-11; AD-154 105.
Order from LC mi$2.40, ph$3.30 PB 135 943

Centrifuge runs with rodents, by several investigators are reviewed. It is concluded that accelerative forces per se would not endanger these animals in bio-satellite experiments. However, environmental stresses and the absence of gravity could lower their resistance, and therefore, a reliable G-protection for the animal is proposed.

Army Medical Nutrition Lab., Denver, Colo.
NEW METHOD OF CALIBRATING THE MÜLLER-FRANZ RESPIRATION GAS METER, by R. P. Riendeau and C. F. Consolazio. 10 June 58, 17p. 7 refs. Rept. 220.
Order from LC mi$2.40, ph$3.30 PB 135 326

A hand respiration pump from an "iron lung" was connected between a tissot spirometer and a Müller-Franz Respiration Gas Meter in such a manner that when it was pumped, all of the air taken out of the tissot had to pass into the meter. Data were collected at six different ventilation levels. A regression equation was calculated from these data using the meter reading and the volume of air withdrawn from the tissot.

Army Medical Research Lab., Fort Knox, Ky.
A GENERAL PURPOSE BLAST TUBE FOR STUDIES OF THE BIOLOGICAL EFFECTS OF SHOCK WAVES, by R. Y. Walker, W. P. Koella and others. Rept. on Effects of Blast on Man. 1 Nov 57, 28p. 16 refs. Rept. no. 321.
Order from LC mi$2.70, ph$4.80 PB 136 719

A general purpose blast tube developed to study the effect of shock waves of different size and shape on the living organism is described. After a discussion of the reasons why extensive blast studies should be performed, a short survey of the presently available literature is presented, and the problems which seem to be most important in this kind of research are discussed. In the second part of this report the functional properties of the research tool developed in this laboratory are described and illustrated by a number of diagrams and photographs.

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
MODIFICATION OF THE THERMAL RADIATION METHOD FOR ASSESSING ANTINOCICEPTIVE ACTIVITY IN THE RAT, by Dorothy J. Cunningham. Rept. no. 13 on Proj. NM 19 01 12.1. 8 Aug 57, 20p. 8 refs. NADC-MA-5713.
Order from LC mi$2.40, ph$3.30 PB 137 047

A modification of the thermal radiation method of measuring thresholds in rats has been described which permits taking into account changes in skin temperature during measurement of antinociceptive activity. The essential measurements to be made include the intensity of the radiation stimulus, the skin temperature prior to stimulation, and the exposure time. With this information available, the reaction response can then be expressed in terms of the significant variable, i.e., the skin temperature at which the reaction occurs. The variability of penetration and reflection of the nonblackened skin of the white rat is not significant; however, application of a blackening agent increases the heat absorbing power of the skin and facilitates the use of the radiation equipment. It has been shown that skin temperature

changes following the administration of drugs represent an important factor which must be considered in the assessment of potential analgesic activity by this method.

Columbia U., New York
RESIDUAL MASKING AT LOW FREQUENCIES, by Cyril M. Harris. Rept. for May 54 - Sep 57 on The Generation, Propagation, Action and Control of Acoustic Energy, Contract AF 33(616)2454. Nov 58, 53p. 3 refs. WADC Technical note 58-221; AD-207 245.
Order from OTS $1.50 PB 151 632

Short duration auditory fatigue has been termed "residual masking." This is the shift in the threshold of hearing following the cessation of a masking tone. A study of curves of residual masking vs. frequency, i.e., "masking patterns," contribute much to our understanding of properties of the hearing mechanism. Data of this type have been obtained in the low frequency range, i.e., for masking tones of 250 cps at sound pressure levels of 110 db and 90 db, following the methods of Munson and Gardner. These masking patterns were obtained 150 and 200 milliseconds following the cessation of the masking tone. In the course of this study--in which three subjects were used--the free-field threshold of hearing for binaural listening was measured between 130 and 1,000 cps. Auditory activity patterns were computed from residual masking patterns, and the loudness of the pure tone masking source was evaluated.

Harvard Medical School, Cambridge, Mass.
VASCULAR FACTORS IN RELATION TO BRAIN INJURY, by John Stirling Meyer. Final rept. 1 Oct 55 - 1 Oct 57 on Contract N5ori-076(71). 28 Aug 57, 5p. 16 refs.
Order from LC mi$1.80, ph$1.80 PB 136 021

Using combined recording techniques developed in this laboratory we have made continuous measurements of local oxygen tension, pH, EEG, steady potentials and vascular caliber in brain ischemia, anoxia, concussion, contusion, laceration, brain stem injury and damage to the respiratory center.

Istituto Nazionale di Oticca (Italy)
ON THE VARIABILITY OF THE ELECTRICAL RESPONSE OF THE HUMAN EYE TO STIMULI OF DIFFERENT COLOR (PART 1); ELECTRORETINOGRAPHIC RESEARCH ON THE PARAMETERS WHICH DEFINE THE EFFICIENCY OF A LIGHT STIMULUS (PART 2) by Marcella Bittini, Ivan Nicoletti, and Lucia Ronchi. Technical note 2 (TN 2-58) on Contract AF 61(052)17. 1 Apr 58, 19p. 11 refs. AFOSR TN-58-408; AD-158 212.
Order from LC mi$2.40, ph$3.30 PB 136 000

The variability of the electroretinographic response obtained from a dark adapted eye with stimuli of different colors (blue, green, yellow, red) has been investigated. If the scotopic b-wave is taken as an index of the efficiency of a light stimulus at high luminance levels, the efficiency seems to depend on the following parameters: total energy, color, duration and total time of variation of the luminance.

Johns Hopkins U., Baltimore, Md.
PHYSICAL PRINCIPLES OF VECTOR BALLISTOCARDIOGRAPHIC MEASUREMENT, by S. A. Talbot. Final rept. on Investigation of the Unloaded Internal Ballistogram: Its Biophysical and Physiological Relation to Cardiac Performance, Contract AF 18(600)1107. June 58, 156p. 55 refs. AFOSR TR-58-72; AD-158 301.
Order from LC mi$7.50, ph$24.30 PB 135 626

This report should interest two types of readers: those dealing with ballistocardiography (BCG) for clinical or physiological information, and those concerned with medical methodology or with the physics of biological systems. We therefore aim at the under standing of engineers and physicists who may be called to work in this field; and of those biologists and clinicians whose special concern with ballistocardiography gives them some prior grasp of the mechanics involved. We will include a review of these mechanical principles, but for readers untrained in biology, will first show from the physical point of view, why ballistocardiography is needed, what it consists of, justification of the physical assumptions (model) used, and what has been done so far.

Minnesota U., Minneapolis.
RESPIRATORY COMPENSATION TO METABOLIC ALKALOSIS IN DOGS: INFLUENCE OF HIGH OXYGEN CONCENTRATION, by J. L. Reeves and E. B. Brown, Jr. June 58, 8p. 13 refs. AFSAM rept. 58-99.
Order from LC mi$1.80, ph$1.80 PB 137 999

Dogs were made alkalotic either by intravenous administration of $NaHCO_3$ or by gastric drainage. In every case some degree of respiratory compensation for the metabolic alkalosis was evident. In no case was compensation complete. The mean increase in CO_2 tension during alkalosis was about one-third that which would have been required to produce complete compensation. Breathing oxygen instead of air did not produce a further significant increase in compensation.

Quartermaster Research and Engineering Center, Natick, Mass.
AMERICAN NEGRO-WHITE DIFFERENCES IN HEAT TOLERANCE, by Paul T. Baker (Pennsylvania State U.). June 58, 24p. 25 refs. Technical rept. EP-75.
Order from LC mi$2.70, ph$4.80 PB 137 368

The physiological responses of American White and Negro soldiers were studied under hot-wet and hot-dry conditions. Under hot-wet conditions 40 pairs of men matched for body fat, weight, and statute were walked around a course at 3-1/2 mph for one hour. Under hot-dry conditions 8 pairs of men also matched for body fat, weight, and stature were studied under 8 different conditions which included combinations of clothing, sun, shade, walking, and sitting. The results of this series of experiments indicated: (1) Under hot-wet conditions with both Negroes and Whites clothed and walking, the Negroes had a higher physiological tolerance. (2) Under hot-dry conditions with both groups clothed, walking, or sitting they had about

equal tolerance. (3) Under hot-dry conditions with both groups nude and exposed to the sun, sun-tanned Whites had the higher tolerance. These results further suggested that the differences found were not a function of transient environmental effects and are mostly genetic in origin.

Quartermaster Research and Engineering Center, Natick, Mass.
HEAT EXCHANGES OF MEN IN THE COLD: EFFECT OF HUMIDITY TEMPERATURE, AND WINDSPEED, by P. F. Iampietro, David E. Bass and others. Sep 58, 16p. 8 refs. Technical rept. EP-99.
Order from LC mi$2.40, ph$3.30 PB 137 856

Six healthy young men were exposed nude during 2 hour exposure periods to various combinations of wind (<1 and 10 mph), temperature (50° and 60°F.), and relative humidity (30% and 95%). These conditions have been identified with cold-wet environments by meteorologists. Skin and rectal temperatures, oxygen consumption, and subjective sensations were recorded. The results indicate that wind had the greatest impact on both the subjective and physiological responses; dry bulb had a marked although lesser effect. Relative humidity had little or no effect on any of the responses except heat production. Thus, under the conditions of this study, little evidence was found for an important role of humidity, per se, on either body heat exchanges or subjective sensations of cold.

Quartermaster Research and Engineering Center, Natick, Mass.
OXYGEN CONSUMPTION AND BODY TEMPERATURES DURING THE NIGHT, by M. B. Kreider, E. R. Buskirk, and D. E. Bass. July 58, 15p. 20 refs. Technical rept. EP-95.
Order from LC mi$2.40, ph$3.30 PB 136 884

Simultaneous measurements of oxygen consumption ($\dot{V}O_2$), rectal temperature (T_r), and mean weighted skin temperature (T_s) were made on 9 young men (32 man-nights), who slept at night in a "comfortable" ambient environment (25.5-27.8°C.). T_r and T_s were also determined in 8 and 10 additional men, respectively, in the same environment. Significant decreases in $\dot{V}O_2$, T_r, and T_s during the night were found. On the average, $\dot{V}O_2$ decreased gradually during the night and reached a low value at 5.1 hours after retiring. In approximately half the subjects, $\dot{V}O_2$ changed in a consistent pattern each night; in the other half, considerable night-to-night variation was observed. T_r decreased an average of 1.2°C. (2.1°F.) during the night. This low point occurred 5.6 hours after retiring and was followed by a slight but significant elevation. In many instances, T_s rose slightly during the first hours, after which it slowly decreased. Examples of intra- and inter-individual variation in the above variables are given. In addition, calculated values for body heat content and cumulative heat debt were found to be 2239 kcal. and 540 kcal., respectively, at the end of the 7-hour period of sleep.

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
EFFECT OF MITOCHROME ON ADENYLATE KINASE, by John Wyeth, B. David Polis, and Herman W. Shmukler. Rept. no. 3 on Proj. NM 001 100 316. Jan 57, 16p. 6 refs. NADC-MA-5703.
Order from LC mi$2.40, ph$3.30 PB 135 507

The new heme protein mitochrome isolated from liver mitochondria was shown to have an activation effect on purified adenylate kinase. This effect was attributable in part to a nonspecific sulfhydryl group protective action found also with glutathione and serum albumin, and in part to a specific interaction between adenylate kinase and mitochrome. The latter reaction presumptively implicates mitochrome further in the aerobic phosphorylation mechanism.

Brooke Army Medical Center, Fort Sam Houston, Tex.
EFFECT OF SEROTONIN CREATININE SULFATE UPON GLUCOSE UPTAKE BY RAT DIAPHRAGM, by M. K. Young, Wanda L. Brown, and Leonard G. Seraile. Rept. on Radiation and Thermal Burns. Oct 58, 7p. 13 refs. Research rept. no. 8-58.
Order from LC mi$1.80, ph$1.80 PB 137 853

The influence of serotonin creatinine sulfate (SCS) upon the uptake of glucose by the isolated rat diaphragm has been studied. The addition of SCS to normal rat plasma in vitro had no effect upon glucose uptake by rat diaphragm. However, the uptake of diaphragm incubated in plasma from animals previously injected with SCS was markedly lower than that of diaphragm incubated in plasma from normal control animals.

California U., Berkeley.
RELATIONSHIP OF TRAUMATIC INJURY TO SERUM LIPOPROTEINS AND TOTAL SERUM CHOLESTEROL, by Oliver de Lalla and John W. Gofman. Aug 58, 8p. 3 refs. AFSAM rept. 58-110.
Order from LC mi$1.80, ph$1.80 PB 138 000

An investigation was made of the effect of traumatic injury in the form of major fracture on serum lipoprotein and cholesterol levels in humans, both for short- and long-term postinjury periods. Significant effects on low-density lipoproteins were observed, but only for the period up to 6 months postinjury. No significant long-term effects on low-density lipoproteins or serum cholesterol were found. The results indicate that human atherosclerosis is not expected to be appreciably influenced by trauma in the form of fracture.

School of Aviation Medicine, Randolph AFB, Tex.
EVALUATION OF THE VAN SLYKE AND HILLER MODIFICATION OF THE METHOD OF SENDROY AS APPLIED TO THE CHLORIDE ANALYSIS OF SALIVA, by Ira L. Shannon and John R. Prigmore.

Rept no. 58-78. May 58, 8p. 13 refs.
Order from LC mi$1.80, ph$1.80 PB 135 998

The Van Slyke and Hiller modification of the method of Sendroy has been evaluated in the determination of salivary chloride. An average recovery rate of 99.4 percent was found when known amounts of NaCl solution were added to saliva filtrates. Storage at refrigerator temperature is recommended if immediate analysis of the fresh specimen is not possible. Centrifugation of fresh saliva produced no significant difference in chloride level when compared to the uncentrifuged sample. Centrifugation times up to 15 minutes did not produce systematic changes in chloride concentration of the saliva, acid, and silver iodate mixture. The iodate-treated filtrate can be stored at refrigerator temperature for as long as 72 hours without altering the chloride content but, after the addition of NaI, titration should be carried out within 3 minutes. A micromethod, requiring only 0.1 ml of saliva, was found to be satisfactory in its coefficient of variation.

School of Aviation Medicine, Randolph AFB, Tex.
INFLUENCE OF EXERCISE AND DIET ON THE BLOOD LIPIDS OF A MILITARY POPULATION, by Bernard S. Schlessinger, Frederick H. Wilson, Jr., and Carrie B. Haven. Oct 58, 6p. 17 refs. Rept. 59-6
Order from LC mi$1.80, ph$1.80 PB 137 985

Blood samples were obtained from a group of 199 basic trainees at the beginning, midpoint, and termination of the 8-week training period. During this period, the subjects were placed on a regiment of extensive physical exercise and a diet high in fat content. Analyses of the blood lipids showed that the concentrations of cholesterol, lipid phosphorus, and S_f^0 20-400 lipoproteins increased, and the levels of S_f^0 0-12, S_f^0 12-20, and 1.2 lipoproteins as well as the atherogenic index decreased. The results indicated a beneficial effect of the physical exercise regimen.

School of Aviation Medicine, Randolph AFB, Tex.
SERUM PARAMETERS AS DISCRIMINATORS BETWEEN NORMAL AND CORONARY GROUPS, by Bernard S. Schlessinger, Frederick H. Wilson, Jr., and Lawrence J. Milch. Oct 58, 5p. 14 refs. Rept. 58-125.
Order from LC mi$1.80, ph$1.80 PB 137 983

Several serum parameters were evaluated as discriminators between a normal (N) and a coronary disease (MI) group. The best discriminating parameters were S_f^0 0-400 lipoprotein concentrations and the calculated atherogenic index. The means of the N and MI groups for each lipoprotein class were significantly separated. Total cholesterol was a less effective discriminator than total β-lipoprotein concentration or atherogenic index, but more effective than β-cholesterol or lipid phosphorus. The data indicate that (a) some importance must be ascribed to the protein components of the lipoprotein moieties, and (b) a re-evaluation of the weighting factors in the calculated atherogenic index might lead to a more sensitive parameter.

School of Aviation Medicine, Randolph AFB, Tex.
STUDIES ON CROSS-ADAPTATION, by Roy B. Mefferd, Jr. (U. of Texas) and Henry B. Hale. Sep 58, 32p. 7 refs. Rept. nos. 58-106, 58-107, 58-108.
Order from LC mi$3.00, ph$6.30 PB 137 966

Contents:
58-106. Effects of abrupt temperature changes on excretion characteristics of rats acclimated to cold, neutral, or hot environments
58-107. Effects of thermal conditioning on metabolic responses of rats to altitude
58-108. Metabolic responses to thermal stressors of altitude-acclimated rats

Texas U. Medical Branch, Galveston.
DISTRIBUTION OF UROKINASE AMONG THE COMMON MAMMALS, by Stanley R. Mohler, D. Robert Celander, and M. Mason Guest. Sep 57, 7p. 24 refs. AFSAM 57-147.
Order from LC mi$1.80, ph$1.80 PB 135 604

Urokinase, a principle capable of activating profibrinolysin to fibrinolysin, has been found in the urine of the cat, rat, cow, rabbit, man, dog, and hamster. Soluble concentrates of this activator were prepared by precipitation of urine with equal volumes of cold acetone, suspension of the precipitate in borate buffer, and sequential dialysis of the suspension against borate buffer (pH 9.2), distilled water, and phosphate buffer (pH 7.25). The ability of the urokinase concentrates from the urine of individual species to activate the profibrinolysin of their own and various other species was measured in a two-stage assay system which is described. The activation of profibrinolysin by urokinase was limited by definite species specificities and did not appear to involve necessarily the intermediation of a plasma prokinase.

General Biology

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
SELECTED BIBLIOGRAPHY CONCERNING PHYSIOLOGICAL FACTORS IN AERO-MEDICAL RESEARCH AND DEVELOPMENT, by Joan C. Robinette. Apr 57, 40p. 348 refs. AD-126 401.
Order from LC mi$3.00, ph$6.30 PB 139 290

The principal topics include thermal physiology and protective garments; toxicity of materials and toxic chemical measurement; respiratory physiology and high altitude protective garments; aircraft visual requirements; nutrition and metabolism.

Army Chemical Warfare Labs., Army Chemical Center, Md.
HEMATOXYLIN AND EOSIN STAINING TECHNIQUE ADAPTED FOR AN AUTOMATIC TISSUE PROCESSOR, by John H. Thompson and Ward R. Richter. Aug 58, 10p. 2 refs. CWL Special Pub. 2-8.
Order from LC mi$1.80, ph$1.80 PB 137 855

Armour Research Foundation, Chicago, Ill.
SUSCEPTIBILITY TO RESPIRATORY INFECTIONS OF ANIMALS EXPOSED TO OZONE, by Sol Miller and Richard Ehrlich. Aug 58, 9p. 9 refs. AFSAM rept. 58-64.
Order from LC mi$1.80, ph$1.80 PB 136 775

A study was undertaken to determine whether sublethal concentrations of ozone contained in the respiratory influent of an animal would sufficiently alter the normal host-parasite balance to effect changes in the susceptibility of the animal to respiratory tract diseases. The experimental sequence used throughout the program consisted of the exposure of mice and hamsters to various concentrations of ozone for various lengths of time and subsequent challenge with aerosol of Klebsiella pneumoniae and Streptococcus sp. The ozone concentration and the time of exposure employed were 1.3 and 4.4 p.p.m. by volume for 3 hours, 0.84 p.p.m. 4 hours per day 5 days per week for 2 weeks, and 0.82 p.p.m. for 100 hours, respectively. Results of the experiments expressed in terms of mortality, LD_{50}, and the surival time indicate that exposure to ozone lowers the resistance of animals to respiratory infections caused by K. pneumoniae and Streptococcus sp. Statistical analysis of the results indicates that the differences in mortality and survival time are significant at the 0.1 percent level for most of the experimental conditions studied.

Army Chemical Warfare Labs., Army Chemical Center, Md.
ATTEMPTS TO PREVENT GENERALIZED H POISONING, by Gerald E. Groblewski and J. H. Wills. Nov 57, 11p. 25 refs. CWLR 2195.
Order from LC mi$2.40, ph$3.30 PB 136 245

Certain sympatholytic compounds, including 2-chloroethlyamine derivatives, are capable of stopping H-induced salivation in the cat. Two of the most effective of these compounds are inactive in preventing generalized H poisoning in the rat. Pentnucleotide, injected I. P. in a dose of 21 mg./kg., has some prophylactic effectiveness against H poisoning of the rat.

Army Chemical Warfare Labs., Army Chemical Center, Md.
EFFECTS OF CONTINUOUS EXPOSURE FOR SEVERAL MONTHS TO VERY LOW CONCENTRATIONS OF CARBON MONOXIDE; A LITERATURE SURVEY, by Nellie M. Anson and Paul A. Parent. Sep 58, 22p. 29 refs. CWL Special Pub. 4-5.
Order from LC mi$2.70, ph$4.80 PB 137 952

Army Medical Research Lab., Fort Knox, Ky.
THE EFFECTS OF AUXILIARY TOPICAL HEAT ON MANUAL DEXTERITY IN THE COLD, by John M. Newton and Lelon J. Peacock. Rept. on Climatic Effects on Psychophysiological Abilities. 16 June 57, 37p. 13 refs. Rept. no. 285.
Order from LC mi$3.00, ph$6.30 PB 136 859

On the basis of this research it is concluded that application of auxiliary topical heat to the forearms results in a lessening of decrement in finger dexterity due to exposure of the hands to an ambient temperature of -18.5°C. At the same time, skin temperatures taken from the back of the hand dropped significantly less as a function of time in the cold when auxiliary heat was applied than when no heat was applied.

Army Medical Research Lab., Fort Knox, Ky.
ROENTGENOLOGICAL BONE CHANGES ENCOUNTERED IN FROSTBITE - KOREA 1950-51, by H. A. Vinson, R. Schatzki (Mt. Auburn Hospital) and K. D. Orr. Rept. on Cold Injury Studies. 10 Jan 53, 26p. 10 refs. Rept. no. 108; AD-11 071.
Order from LC mi$2.70, ph$4.80 PB 136 720

A group classification of bone changes produced by frostbite was devised as follows: (1) Group A showing osteoporosis. (2) Group B showing acromutilation (mutilation of terminal phalanges due to exposed bone). (3) Group C showing juxta articular areas of decreased density. (4) Group D showing other bone changes (i.e. periostitis, new bone formation and osteomyelitis). The most common bone abnormality was that of osteoporosis. This finding plus the one of periostitis are useful indicators of the viability of the underlying bone pointing to an intact circulation and metabolism. The absence of osteoporosis in phalanges while being present in metatarsal and tarsal bones is suggestive of alteration or absence of circulation in the involved phalanges.

Chicago U., Ill.
FURTHER OBSERVATIONS ON POSTMORTEM CHANGES IN THE VESTIBULAR AND COCHLEAR RECEPTORS (GUINEA PIG) by Cesar Fernández. May 58, 29p. 14 refs. AFSAM Rept. 58-80.
Order from LC mi$2.70, ph$4.80 PB 136 855

A study was made under light microscopy of the sequence of histologic changes of the vestibular and cochlear structures in guinea pigs as autolysis progressed. Intravital fixation was the ideal procedure to preserve the inner ear structures from autolysis and artifacts. With postmortem perfusion, the first changes (loss of tigroid substance and swelling) appeared in the ganglion cells approximately 20 minutes after death. Swelling, homogenization, pyknosis, and karyolysis progressed rapidly in the nervous elements. In nonnervous tissue, the autolytic process was slower, the first sign appearing as swelling of the cells of the cochlear and vestibular receptors, approximately 1 hour after death. In postmortem immersion penetration of the fixative was a slow process, taking hours to reach the inner ear structures, and therefore the changes which appeared were nothing other than postmortem changes.

Navy Experimental Diving Unit, Naval Gun Factory, Washington, D. C.
EFFECTS OF EXPOSING MEN TO COMPRESSED AIR AND HELIUM-OXYGEN MIXTURES FOR 12 HOURS AT PRESSURES OF 2 2.6 ATMOSPHERES, by G. J. Duffner and H. H. Snider. 18 Sep 58, 20p. 4 refs. Research rept. 1-59.
Order from LC mi$2.40, ph$3.30 PB 138 116

Five men were exposed for 12 hours in a recompression chamber to increasingly greater pressures until they contracted decompression sickness. The pressure in all cases was reduced at a rate of 25 ft. per minute. The exposures were performed first while breathing compressed air and then later 80% helium - 20% oxygen. Greater exposures were tolerated with the H_eO_2 mixtures than with air. The difference amounted to pressures equivalent to 3, 4, 6, 10, and 14 ft. of sea water. Data on helium elimination disclosed that a large fraction of the dissolved helium is contained in a tissue component which desaturates very rapidly. The existence of a slow component appears likely. The use of helium-oxygen mixtures in mixed gas scuba and the utilization of a single mathematical expression to compute decompression stops are considered feasible.

Navy Experimental Diving Unit, Naval Gun Factory Washington, D. C.
A METHODOLOGICAL TEST OF RESISTANCE OF DIVERS TO DECOMPRESSION SICKNESS, by J. F. Snyder and G. J. Duffner. 13 Nov 58, 25p. Research rept. 4-59.
Order from LC mi$2.70, ph$4.80 PB 137 969

Intended primarily as a methodological criterion study, this research also examined Duffners' "square root method" of calculating levels of exposure to pressure and subsequent schedules of decompression. It was found that scores on an interval scale were a more efficient expression of the criterion than frequency of occurrence alone. The results tend to support Duffners' hypotheses as they relate to calculations of relative exposure. A low level correlation was observed between sensitivity to pain (mild electric shock) and susceptibility to decompression sickness. All results are considered tentative pending cross-validation with increased exposure and resultant higher percentage of post-dive reactions.

School of Aviation Medicine, Randolph [AFB] Tex.
COMPARISON OF AUDITORY ACUITY OF FLYING PERSONNEL AND NON-FLYING PERSONNEL, by David E. Shoch. July 49, 6p. 17 refs. Proj. no. 514, rept. no. 1; AD 131 864.
Order from LC mi$1.80, ph$1.80 PB 139 357

(1) Young healthy males without flight experience in the 20-30-year age group show a high tone loss of from 10 to 12 decibels. (2) A similar group of young males with flying experience (average 1400 hours) show a high-tone loss of 17 decibels. (3) This difference in acuity for high tones is statistically significant and indicates not that the loss of high tones in flying personnel is due simply to aging, but that there is an additional factor of acoustic trauma. (4) Hearing loss in fliers must be looked upon as an occupational disease varying greatly with individual susceptibility. In light of this, a reappraisal of current hearing standards from the standpoint of job performance rather than adherence to an arbitary standard is essential.

School of Aviation Medicine, Randolph [AFB] Tex.
EAR PLUG PROTECTION AGAINST NOISE AND CONCUSSION OF GUNFIRE, by Fred W. Ogden. 18 Nov 44, 12p. 10 refs. Proj. no. 326, rept. no 1; AD-135 561.
Order from LC mi$2.40, ph$3.30 PB 139 351

To determine by a field test the amount of hearing protection afforded by several types of readily available ear plugs against the noise of gunfire.

School of Aviation Medicine, Randolph [AFB] Tex.
EFFECT OF EXPOSURE TO AIRPLANE NOISE ON AUDITORY ACUITY, by Ben H. Senturia. 11 Dec 43, declassified 15 Aug 45. 8p. 8 refs. Proj. no. 205, rept. no. 1; AD-135 563.
Order from LC mi$1.80, ph$1.80 PB 139 355

Conclusions and Recommendations: a. Pure tone auditory threshold tests were obtained on one hundred (100) enlisted trainees who had had no recent exposure to airplane noise. b. Threshold determinations were repeated on the seventy-four (74) subjects (148 ears) who had successfully completed nine weeks of primary training. c. 18.9 per cent of the re-examined ears showed an elevation of threshold of 15 decibels or more at one or more of the nine frequencies tested. This elevation occurred most often at the frequencies 2896, 4096, and 5792 cps. d. Attention is directed to the fact that these changes may be the result of auditory fatigue, permanent cochlear damage, or both. Further observations on these same individuals will be made after basic and advanced flight training.

School of Aviation Medicine, Randolph [AFB] Tex.
EFFECT OF EXPOSURE TO AIRPLANE NOISE ON AUDITORY ACUITY, by Ben H. Senturia. 26 May 44, 8p. 3 refs. Proj. no. 205, rept. no. 2; AD-135 564.
Order from LC mi$1.80, ph$1.80 PB 139 354

In an effort to determine the effect of aircraft noise upon auditory thresholds, arrangements were made to test the hearing acuity of a group of student pilots just prior to flight training and to repeat these tests after primary, basic, and advanced courses, respectively. Most auditory thresholds were obtained two to eight hours after the completion of flights. Consequently, all findings should be interpreted in the light of possible hearing losses resulting from temporary cochlear fatigue.

School of Aviation Medicine, Randolph [AFB] Tex.
EFFECT OF EXPOSURE TO AIRPLANE NOISE ON AUDITORY ACUITY, by Ben H. Senturia. 4 Aug 44, 8p. 8 refs. Proj. no. 205, rept. no. 3; AD-135 565.
Order from LC mi$1.80, ph$1.80 PB 139 352

It may be concluded that hearing losses incurred during primary, basic, or advanced pilot training are, on the whole, temporary losses which are partially or completely recovered following 24 hours of rest.

School of Aviation Medicine, Randolph [AFB] Tex.
EFFECT OF FLIGHT UPON HEARING ACUITY, by Paul A. Campbell. 22 Jan 42, declassified 15 Aug 45. 4p. 4 refs. Proj. no. 5, rept. no. 1; AD-132 939.
Order from LC mi$1.80, ph$1.80 PB 139 356

A detailed study of men participating in aircraft flight has demonstrated that age, noise, and changes in barometric pressure cause losses in certain frequencies within the range of hearing. These losses may affect those frequencies used in conversation and may decrease conversational, interphone, or radio intelligibility during flight.

School of Aviation Medicine, Randolph [AFB] Tex.
EFFECT OF GUNFIRE NOISE UPON AUDITORY ACUITY FOR PURE TONES, by Fred W. Ogden. 30 Sep 44, 14p. 6 refs. Proj. no. 315, rept. no. 1; AD-135 557.
Order from LC mi$2.40, ph$3.30 PB 139 353

The noise of gunfire does produce a definite loss of hearing for high tones (2048-11584 cps) among gunnery instructors. Among the seven (7) groups of instructors examined, the Air Specialists showed the least amount of hearing loss. The instructors on the shotgun ranges showed the greatest amount of hearing loss. A major portion of the temporary high tone hearing loss which is present immediately after exposure to the noise of gunfire is recovered in the subsequent 24 to 48 hours.

Pharmacology and Toxicology

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE BIOLOGICAL AND CLINICAL PROPERTIES OF MAGNESIUM: AN ANNOTATED BIBLIOGRAPHY, by Paul F. Robinson. Sep 58, 86p. 400 refs. CWL Special Pub. 2-12.
Order from LC mi$4.80, ph$13.80 PB 137 962

Army Chemical Warfare Labs., Army Chemical Center, Md.
OBSERVATIONS ON TEST TREATMENTS OF n-PROPYL NITRATE POISONING, by Dorothy E. Stabile and Edmund F. Murtha. Sep 57, 6p. 2 refs. CWL Technical memo. no. 26-4.
Order from LC mi$1.80, ph$1.80 PB 137 129

The current investigation was to select and test various drugs on the basis of their possible ability to reverse the toxic effects of n-propyl nitrate in an effective treatment for n-propyl nitrate intoxication. It was assumed, however, that if this objective were not achieved, the findings might be valuable to other investigators in this field by conserving and guiding their approaches to therapy. All test measures listed were ineffective.

Chemical Corps Medical Labs., Army Chemical Center, Md.
CLINICAL DATA ON ORGANIC PHOSPHORUS INSECTICIDE POISONING, by Gustave Freeman. Sep 52, declassified. 14p. 4 refs. Special rept. no. 16.
Order from LC mi$2.40, ph$3.30 PB 137 024

The purpose of this report is to collect scattered data pertaining to accidental poisoning with organic phosphorus insecticides in the United States that have not already been presented in organized studies.

School of Aviation Medicine, Randolph [AFB] Tex.
ACTION OF ANTIHISTAMINE SOLUTIONS APPLIED TO THE MUCOUS MEMBRANES OF THE NOSE, by Leslie N. Gay and Leroy M. Polvogt (Johns Hopkins U.). May 53, 7p. Proj. no. 21-1208-0010, rept. no. 1.
Order from LC mi$1.80, ph$1.80 PB 135 468

School of Aviation Medicine, Randolph AFB, Tex.
THE EFFECTIVENESS OF DRUGS AGAINST MOTION SICKNESS: PERPHENAZINE AND SYSTRAL, by Lawrence J. Milch, Harold D. Frankl, and A. A. Renzi. Dec 58, 4p. 10 refs. Rept. 59-20.
Order from LC mi$1.80, ph$1.80 PB 137 929

Trilafon (perphenazine), a drug with high activity against apomorphine-induced vomiting in dogs, and systral, an antiemetic analog of benadryl with little or no activity against apomorphine-induced vomiting in dogs, were tested for anti-motion sickness activity in humans abroad aircraft. Neither furnished any protection. These data emphasize the unreliability of extending the results of apomorphine inhibition to the relationship of the chemoceptive trigger zone to motion sickness.

School of Aviation Medicine, Randolph AFB, Tex.
EVALUATION OF A COMMERCIAL MEDIUM FOR RAPID DETERMINATION OF ANTIBIOTIC SUSCEPTIBILITY, by Charles E. Craft. Aug 58, 4p. 5 refs. Rept. 58-119.
Order from LC mi$1.80, ph$1.80 PB 137 875

In determining the susceptibility of certain microorganisms to various antibiotics, a commercially prepared medium has effectively been used as the base layer of the rapid hemoglobin reduction test. Less definite color changes, occurring in the commercial medium, make the zones of inhibition harder to distinguish than in the 20 percent blood agar plates currently used. The commercial medium is comparable to the other, however, in ability to demonstrate zones of inhibition, and it has the advantage of being immediately usable, easily disposed of, and relatively inexpensive.

Radiobiology

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
HEALTH-PHYSICS PROCEDURES FOR AN AERO-

MEDICAL RADIOISOTOPES LABORATORY, by Thomas J. McGuire. Rept. on High Altitude Physiology. Mar 57 [35]p. 11 refs. WADC Technical rept. 57-142; AD-118 113.
Order from OTS $1.00 PB 131 196

Iodine-131, Sodium-24, and Chromium-51 are the isotopes to be handled in tracer work involving studies on the effect of simulated altitude on laboratory animals. The handling of radioactivity by any installation requires that specific Health-Physics procedures be followed to adequately insure the health and safety of the personnel involved. Recommendations are applicable to the installations setup, equipment selection, health monitoring, isotopes handling, personnel protection, waste disposal and decontamination.

Army Medical Research Lab., Fort Knox, Ky.
ALTERATIONS IN IODINE-131 DISTRIBUTION IN THE RAT AFTER WHOLE BODY X-IRRADIATION, by D. D. Ulmer, L. B. Perkins, and J. G. Kereiakes. Rept. on Effects of Low, Medium, and Massive Doses. 24 July 58, 17p. 34 refs. Rept. no. 345.
Order from LC mi$2.40, ph$3.30 PB 137 312

Twenty-four hours after exposure of rats to whole body X-irradiation and injection of I-131 the stomach contents and pelt showed a marked increase in concentration of radioiodine. The blood and other organs showed less marked increases as compared to non-irradiated controls. X-irradiation diminished the amount of I-131 lost into the urine and feces.

Army Medical Research Lab., Fort Knox, Ky.
CARBOHYDRATE METABOLISM IN YEAST ACCOMPANYING AN INHIBITION OF CELL DIVISION BY X-RAYS, by Edward Spoerl and Della Looney. Rept. on Effects of Ionizing Radiation. 17 Dec 57, 13p. 10 refs. Rept. no. 312.
Order from LC mi$2.40, ph$3.30 PB 137 883

Control and continuously irradiated yeast cells, from cultures growing in the exponential phase at 0 hours, were analyzed at 0, 2, 4, and 6 hours for total carbohydrate and for several carbohydrate fractions. Cell division was inhibited by irradiation, but the cells enlarged in size. All carbohydrate fractions were reduced during the 6 hour period compared to unirradiated cells. Mannan showed a significant drop at 2 hours, but this did not become progressively greater. Glucan and acid extractable glycogen showed a marked progressive decrease. TCA-extract carbohydrate showed a dip at 2 hours, but a marked drop only at 6 hours at which time total glycogen also was reduced. A radiation effect resulting in increased permeability also was observed. It is quite possible that radiation may affect cell wall formation and in turn cell division.

Army Medical Research Lab., Fort Knox, Ky.
THE EFFECT OF SUBCUTANEOUSLY INJECTED COBALT ON THE ERYTHROPOIETIC ACTIVITY AND RADIOSENSITIVITY OF X-IRRADIATED MICE, by W. H. Parr and R. A. Van Metre. Rept. on Effects of Ionizing Radiation. 11 Apr 58, 20p. 18 refs. Rept. no. 332.
Order from LC mi$2.40, ph$3.30 PB 137 309

A single subcutaneous dose of 1. 0 mg cobaltous-chloride per 10 gm body weight stimulated the erythropoietic activity of CF_1 mice surviving the toxic effects. Single doses below this level gave little indication of increasing the red blood cell count while doses beyond this level were lethal to all mice. Daily subcutaneous injections of 0. 8 mg cobaltous-chloride per 10 gm body weight increased red blood cell formation in mice that survived the toxic effects. With daily subcutaneous injections (0. 8 mg per 10 gm body weight) given in combination with a single lethal dose of x-rays, cobalt's erythropoietic stimulating property was less obvious, but an increase in radiosensitivity was observed. Daily doses of less than 0. 6 mg cobaltous-chloride per 10 gm body weight had little effect on the red cell count or on the radiosensitivity.

Army Medical Research Lab., Fort Knox, Ky.
EFFECTS OF X-RAYS ON ISOHEMAGGLUTININS, by A. J. Luzzio and Vasilios Evangelinos. Rept. on Effects of Low, Medium and Massive Doses. 18 July 58, 9p. 15 refs. Rept. no. 344.
Order from LC mi$1.80, ph$1.80 PB 137 311

Exposure of human red blood cell agglutinins in immune sera to X-rays resulted in the inactivation of specific groups. Other blood group determining sites remained unaffected at the same dose levels. The results indicate that various antibody-combining sites possess specific radiosensitivities. Practical applications to studies on antibody structure and sterilization of immune blood proteins are discussed.

Army Medical Research Lab., Fort Knox, Ky.
ORGAN WEIGHT CHANGES IN GRID-SHIELDED X-IRRADIATED RATS, by J. G. Kereiakes, W. H. Parr and others. Rept. on Effects of Low, Medium, and Massive Doses. 28 July 58, 14p. 9 refs. Rept. no. 348.
Order from LC mi$2.40, ph$3.30 PB 136 860

The findings confirm the beneficial effect of partial shielding by grids on survival of X-irradiated rats. For rats receiving equal mid-line doses through grids of constant percent open area, there is increased survival with decreasing grid aperture size. In addition a delay in the timely distribution of intestinal deaths was noted for smaller aperture size grids, although this delay was not reflected by intestinal weight changes. Small changes, significant in some instances, were observed in spleen, liver, and kidney weights. These changes did not appear to follow the increased survival pattern observed for rats irradiated through grids of decreasing aperture size.

Army Medical Research Lab., Fort Knox, Ky.
RELATIVE BIOLOGICAL EFFECTIVENESS OF COBALT 60 GAMMA RADIATION FOR VARIOUS RESPONSES IN MICE, by J. G. Kereiakes and M. S. Miraglia. Rept. on Effects of Low, Medium, and Massive Doses. 26 Apr 58, 21p. 20 refs. Rept. no. 337.
Order from LC mi$2.70, ph$4.80 PB 137 310

The biological effectiveness of cobalt 60 gamma irradiation relative to 250 kvp X-irradiation for six different responses in a single mammalian system, CF_1 mice, were found to be: 30-day lethality, 0.76; median survival time, 0.78; body weight loss, 0.76; intestinal atrophy, 1.00; spenic atrophy, .1.00; and testicular atrophy, 0.60. Possible reasons for the differences are discussed.

School of Aviation Medicine, Randolph AFB, Tex.
A SEMI-MICROTECHNIC FOR IRON-59 DETERMINATIONS IN BIOLOGIC SYSTEMS, USING BETA COUNTING IN A LIQUID SCINTILLATOR, by Thomas P. Leffingwell, George S. Melville, Jr., and Robert W. Reiss (U. of Texas). June 58, 6p. 17 refs. Rept. 58-93.
Order from LC mi$1.80, ph$1.80 PB 138 120

This paper describes a technic for digesting iron-containing components of biologic systems, reducing and complexing the iron, and selectively extracting and concentrating the complex. In this form, total iron may be measured spectrophotometrically and then introduced into a liquid scintillator solution which permits beta counting of any Fe^{59} present.

School of Aviation Medicine, Randolph AFB, Tex.
SOME EFFECTS OF IONIZING RADIATIONS ON CREATINE PHOSPHOKINASE, by Donald R. Anderson. Aug 58, 9p. 23 refs. Rept. 58-115.
Order from LC mi$1.80, ph$1.80 PB 137 876

This report presents information concerning the inactivation of creatine phosphokinase by ionizing radiation and the protection against radiation damage afforded the enzyme by several compounds. Aqueous solutions of creatine phosphokinase were inhibited by Co^{60} gamma radiation. An exponential inactivation curve resulted. Irradiation at various enzyme concentrations showed the G yield increasing with increasing concentrations. A maximum G value of 0.47 was obtained. Investigation indicated that probably the OH radical was responsible for the inhibition of enzyme activity. The enzyme was studied using AET salts as protective and reactivating compounds. pH and concentrations of the protective compounds were investigated in relation to their protective capacity. A protective mechanism involving a "shielding" linkage rather than a "radical sink" process has been suggested to account for the protective effect of some of these compounds.

School of Aviation Medicine, Randolph AFB, Tex.
TOXICOLOGIC STUDIES WITH YTTRIUM NITRATE AND LANTHANUM NITRATE AS MODIFIED BY SITE OF INJECTION AND WHOLE-BODY RADIATION, by Quentin L. Hartwig, Thomas P. Leffingwell, and George S. Melville, Jr. July 58, 8p. 6 refs. Rept. 58-88.
Order from LC mi$1.80, ph$1.80 PB 137 878

Yttrium and lanthanum, in the nitrate form, were administered by various avenues to rats; some of which had been subjected to whole-body irradiation by Co^{60} gamma rays. Rats receiving intraperitoneal injections of yttrium nitrate plus whole-body exposure to ionizing radiation evidenced a higher mortality (significant to the 5 percent confidence level) than rats receiving either radiation or intraperitoneal injections of yttrium nitrate alone. Subcutaneous injection of 200 mg- of yttrium or lanthanum nitrate caused abscess formation and subsequent epilation. No effect was noted when sodium nitrate or saline were similarly injected into rats. The presence of yttrium and lanthanum nitrates caused delayed healing of wounds. Similar effects were not produced when sodium nitrate was administered in the same manner.

CHEMISTRY

North Carolina U., Chapel Hill.
TRIPHENYLPHOSPHONIUM SALTS, by J. C. Sheldon and S. Y. Tyree. Technical rept. no. 2 on Synthesis of New Inorganic Molecules, Contract Nonr-855(05). 1 Oct 57, 21p.
Order from OTS $0.75 PB 151 181

Triphenylphosphonium salts of HCl, $HClO_4$, HI, $HSbCl_4$, $HFeCl_4$, H_2SnCl_6, $HFeBr_4$, and H_2SnBr_6 have been prepared and characterized briefly. It is suggested that absorption spectroscopy is the most definitive means of establishing the presence of the -onium structure.

[Rock Island Arsenal Lab., Ill.]
OZONE BIBLIOGRAPHY, by Z. T. Ossefort. 10 Jan 55, 41p. 472 refs. RIA Lab. no. 55-88; AD-143 081.
Order from LC mi$3.30, ph$7.80 PB 136 486

This bibliography contains 402 literature references, 66 patent references, and 4 references to books. The references are arranged alphabetically by author and cover the period 1917 to 1954.

Analytical Chemistry

[Army Rocket and Guided Missile Agency, Redstone] Ala.
METHODS OF ANALYSIS OF HYDROGEN PEROXIDE, by Wilbur A. Riehl, John R. Nunnelley, and David D. Watson. 1 May 54, 45p. 23 refs. Rept. no. R-59.
Order from LC mi$3.30, ph$7.80 PB 137 670

Methods of analysis of aqueous solutions of hydrogen peroxide in the range of 75% concentration have been evaluated and surveyed. It was found that the permanganate titration method will yield results accurate to 0.1%. For analysis in the field accurate to 0.1%, it is recommended that the permanganate method be suitably modified for such use.

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
CHEMICAL INVESTIGATION OF CONDENSATE

OF MIL-S-11090A, SOLVENT, DEGREASING, SELF-EMULSIFYING, by J. Sprague. 21 Nov 57, 21p. 9 refs. Rept. no. CCL-37
Order from LC mi$2.70, ph$4.80 PB 136 242

The object of this study is to determine the active principle(s) present in the self-emulsifying cleaner MIL-S-11090 in order to provide a sound basis for cleaner improvement.

Organic Chemistry

Chicago U., Ill.
HYDRIDES AND BOROHYDRIDES OF LIGHT WEIGHT ELEMENTS AND RELATED COMPOUNDS, by H. I. Schlesinger and Riley Schaeffer. Technical rept. for 1 Aug 51-31 July 52 on Contract N6ori-020(10). 1 Aug 52. 32p. ATI-188 379.
Order from LC mi$3.00, ph$6.30 PB 139 286

Contents:
Sub-halides of boron. The compound B_4Cl_4
Reactions of diborane with hydrizine and with sym.-dimethyl hydrazine
Solubility of diborane in ether and the reaction between lithium borohydride and borofluoride in ether solution
Borazole studies
Chemical reactions of Pentaborane, B_5H_9

[Cornell U., Ithaca, N. Y.]
INTERACTIONS OF LINEAR POLYMERS WITH SOLVENTS AND SWELLING AGENTS, by J. L. Hoard and F. A. Long. Progress rept. no. 34, 1 Oct 54-31 Mar 55 on Polymer Research, Contract DA 30-115-ORD-241. 15 Apr 55, 22p. 13 refs.
Order from LC mi$2.70, ph$4.80 PB 139 199

Studies have been made of the influence of water vapor on both the sorption and desorption of acetone in polyvinyl acetate. For sorption, initially dry films of polymer were exposed to the mixed vapors (at known pressures) and the weight increase recorded as a function of time. For desorption a film which was equilibrated with mixed vapors was swept by a stream of humidified nitrogen in which the pressure of water was the same as that used to equilibrate the film. This permitted desorption of the acetone at a constant pressure of water. Experiments were made at 40° with water pressures ranging from 8 to 48 mm. (relative humidities from 15 to 85%). It is found that the presence of water leads to more rapid diffusion of the acetone both for sorption and desorption. The effect appears to be due to the plasticizing action of the water. On a volume basis water is up to nine times more effective than an equivalent quantity of acetone. Further studies are reported on the two-stage sorption of methylene chloride into films of polystyrene which are below their glass transition temperature. It is found that the diffusion coefficient calculated for the initial stage is independent of film thickness, lending further support to the conclusion that Fick's Law is obeyed for this stage of the sorption. The initial values of S_2, the second stage slope, are also found to be independent of film thickness. A set of similar experiments have been made with carbon disulfide vapor.

Harvard U., Cambridge, Mass.
SOME STUDIES IN ORGANOMETALLIC CHEMISTRY, by Dietmar Seyferth. Technical rept. on Contract Nonr-1866(13). Aug 57, 56p. 54 refs.
Order from LC mi$3.60, ph$9.30 PB 136 152

Contents:
Vinyl derivatives of the metals. V. Free radical addition reactions of triethylvinyltin
Vinyl derivatives of the metals. VII. The preparation of organotin esters by the cleavage of vinyltin compounds
Di-n-butyldivinyltin
Neopentyl group analogs. I. The preparation and some cleavage reactions of trimethylsilylmethyl-substituted tin compounds
Neopentyl group analogs. II. Tris-(trimethylsilylmethyl) compounds of phosphorus, arsenic, antimony and bismuth and their derivatives
Cycloalkyl- and secondary alkyltin compounds and their cleavage by iodine in benzene solution

Illinois U., Urbana.
CHEMISTRY OF HYDRAZINE, by L. F. Audrieth and Betty Jane Ackerson. Rept. on Contract N6ori-071(20). Apr 49, 316p. 27 refs. ATI-87 815.
Order from LC mi$11.10, ph$48.60 PB 139 281

Contents:
The hydronitrogens
Formation and preparation of hydrazine
Preparation of concentrated and anhydrous hydrazine
Physical properties of anhydrous hydrazine
Properties of aqueous solutions of hydrazine
Oxidation of hydrazine
Quantitative determination of hydrazine
Hydrazine salts
Coordination compounds of hydrazine
Anhydrous hydrazine as a solvent
The hydrazine system of compounds

North Dakota, Grand Forks.
ORGANOMETALLIC CHEMISTRY OF TRANSITION METALS, by Lawrence Summers. Interim technical rept. no. 4, 1 June 55-31 May 56, on Contract Nonr-582(00). 25 Oct 57, 8p.
Order from OTS $0.50 PB 151 180

Shell Development Co., Emeryville, Calif.
METHANEPHOSPHONYL DICHLORIDE, by E. R. White, L. B. Scott and others. Final rept. on Contract DA 18-108-cml-721. 30 Sep 50, declassified 28 Apr 58, 32p. 12 refs. Rept. no. S-13238.
Order from LC mi$3.00, ph$6.30 PB 137 075

South Carolina U., Columbia.
NEW PRODUCTS FROM THE REACTION OF BENZOYL PEROXIDE WITH BENZENE, by DeLos F. DeTar and R. A. J. Long. Rept. on Contract AF 49(638)88. 13 June 58, 3p. 5 refs. AFOSR TN-58-602; AD-162 127.
Order from LC mi$1.80, ph$1.80 PB 138 983

A new study was made of the reactions of aroyl peroxides with benzene at relatively high dilution in a study of the detailed reaction mechanisms. Previous product studies have utilized quite concentrated solutions leading to results complicated by induced decomposition of the peroxide and by the attack of radicals on the initial products.

Texas U., Austin.
ORIENTATION IN THE NITRATION OF ortho-NITROTOLUENE, by Joel D. Watkins, Royston M. Roberts, and Kenneth A. Kobe. Technical rept. on Contract DAI 23-072-501-ORD(P)-6. 15 Nov 57, 53p. 25 refs.
Order from LC mi$3.60, ph$9.30 PB 136 287

Physical Chemistry

Applied Science Research Lab., U. of Cincinnati, Ohio.
ENERGY OF AQUEOUS WETTING OF BULK SURFACES, by Philip E. Berghausen, Robert J. Good and others. Rept. on Surface and Interface Phenomena of Matter, Contract AF 33(616)3387. Nov 58, 57p. 18 refs. WADC Technical rept. 58-385; AD-207 527.
Order from OTS $1.50 PB 151 593

This research was carried out to gain thermochemical information of liquid-solid interfaces resulting from interaction between water and various solids. The work developed on two different lines simultaneously: (1) The heat of aqueous wetting of bulk surfaces such as aluminum foil was studied calorimetrically. (2) The aqueous heat of wetting of polymers was also studied calorimetrically. The heat of immersion of aluminum foil has been studied. This heat consists of an immediate heat and a slow heat. The average value of the immediate heat amounts to 980 erg/cm^2 evolved (standard deviation +320 ergs/cm^2). This value is rather close to the value of 679 ergs/cm^2 for alumina. Oxidized aluminum foil shows a similar immediate heat of wetting; however, the slow heat is appreciably reduced. The aqueous heats of immersion of polyvinylchloride, polystyrene, polyacrylonitrile and a copolymer of acrylonitrile with vinylchloride have been measured calorimetrically. The heats of immersion for polyvinylchloride and polystyrene are positive, that is heat is absorbed on immersion. Whether polyvinylchloride was completely purified is not known. This positive heat of immersion is due to an increase in entropy of water when adsorbed on the surface. Polyacrylonitrile shows a large negative heat of immersion; this is due to hydrogen bonding between this polymer and water. The copolymer also has a negative heat of immersion but smaller than that for polyacrylonitrile.

Athens U. (Greece)
INVESTIGATION OF HEAT VIBRATIONS IN SOLIDS BY USING X-RAYS, by K. D. Alexopoulos. Final rept. on Contract AF 61(514)1248. Feb 58, 11p. 3 refs. AFOSR TN 58-225; AD-154 126.
Order from LC mi$2.40, ph$3.30 PB 136 192

The present report describes experiments carried out in order to determine the characteristic temperature of various elements. The method consists in scattering a pencil of X-rays on the material under consideration and measuring the intensity of the diffracted rays.

Cryogenic Engineering Lab., Mass. Inst. of Tech., Cambridge.
MEANS FOR PRODUCING AND MAINTAINING VERY LOW TEMPERATURES. by S. C. Collins. Final rept. on Contract N5ori-078(23). 14 Apr 58, 65p. 14 refs.
Order from LC mi$3.90, ph$10.80 PB 139 363

One of the principal aims of this investigation has been to reduce the cost of refrigeration at very low temperatures. In the course of this investigation it has been possible to demonstrate the practicability of liquefying helium (aside from the cost of the gaseous helium) at about twice the cost of producing liquid nitrogen, and at only a fraction of the cost of liquefying helium a few years ago. An analysis of refrigeration cycles and heat exchange systems which led to an improved liquefaction cycle is given. Practical improvements in apparatus which reduce required manpower for operation and maintenance are described. Certain applications of low-level refrigeration are discussed.

Industrial Test Lab., Philadelphia Naval Shipyard, Pa.
DETERMINATION OF MICELLES IN DETERGENT SOLUTIONS BY A RADIOTRACER METHOD, by T. F. Boyd. May 56, 22p. 8 refs. Research and Development rept. 6200A-7.
Order from LC mi$2.70, ph$4.80 PB 137 092

A method has been developed for the determination of micelles in detergent solutions with the aid of radiotracers. Detergent solutions containing radioactive sodium dodecyl benzene sulfonate and builders were dialyzed using sausage casings as a membrane. The amount of detergent on each side of the membrane was determined by radiotracer techniques. From the amounts found, calculations were made to determine the amount of detergent present in micellar form and the point of critical micelle formation was approximated. Increasing the sodium ion concentration increases the amount of detergent in micellar form and decreases the critical micelle concentration. It was also found that the micelle formation was the same at equal sodium concentrations of various builders.

Institute of Polymer Research, Polytechnic Inst. of Brooklyn, N. Y.
PROGRESS REPT. FOR AUGUST 1-OCTOBER 31, 1953. Rept. on Contract Nonr-1129(00). Nov 53, 6p. AD-25 127.
Order from LC mi$1.80, ph$1.80 PB 136 168

North Dakota U., Grand Forks.
ORGANOMETALLIC CHEMISTRY OF TRANSITION METALS, by Lawrence Summers and Ann Holmes. Interim technical rept. no. 3, 1 June 54-31 May 55, on

Contract Nonr-582(00). Sep 57, 21p.
Order from LC mi$2.70, ph$4.80 PB 135 722

Metals involved titanium, zirconium, and chromium for various organometallics.

Rensselaer Polytechnic Institute. Chemistry Dept., Troy, N. Y.
ELECTROCHEMISTRY OF MOLTEN ALKALI AND ALKALINE EARTH HALIDES CONTAINING HALIDES OF TITANIUM, by Charles T. Brown, Henry J. Gardner and others. Technical rept. no. 4 on Contract Nonr-591(06), Oct 57, 161p. 58 refs.
Order from OTS $3.00 PB 151 155

A review of the systems used for the electrolytic production of titanium is presented, followed by a discussion of the physical properties of the alkali metal titanium fluorides. The development of the theories of conductance and cryoscopy in ionic melts up to the present time is considered. A precision conductance bridge has been constructed for this work. A linear cooling device and a recording thermometer have been set up for the cryoscopic investigations. A study of the thermal stability and hydrolysis of Li_2-TiF_6 has been carried out. The specific conductance of the KCl-LiCl eutectic mixture containing NaCl, LiF NaF, KF, Li_2TiF_6, Na_2TiF_6, and K_2TiF_6 is reported. Freezing point depressions are reported for the eutectric mixture containing the seven solutes listed above. (See also PB 126 989, 127 141, and 151 156)

Ultrasonic and Electrochemistry Research Lab., Western Reserve U., Cleveland, Ohio.
THE OXYGEN ELECTRODE, by R. R. Witherspoon, Herman Urbach and others. Technical rept. no. 4 on Contract Nonr-581(00). 1 Oct 54, 142p. 40 refs. AD-46 161.
Order from LC mi$7.20, ph$22.80 PB 137 937

The kinetics of the O electrode were studied on C surfaces by means of cathodic polarization measurements. The polarization was determined by the indirect method with electronic instrumentation. The characteristics of the O electrode were obtained as a function of the type of C surface, the nature of the electrolyte, ionic strength, pH, peroxide concentration, temperature, O pressure, current density, time, and catalysts included with the C. A brief survey of the literature pertaining to the O electrode is given. The concentration polarization at an O electrode is considered theoretically; the results compare favorably with the experimentally determined polarization data.

University of Southern California, Los Angeles.
STUDIES OF THE RARE-EARTH HYDRIDES, by James C. Warf, Jerry Donohue and Kenneth Hardcastle. Technical rept. II, Nov 56-Oct 57, on Contract Nonr-228(15). Oct 57, 7p.
Order from LC mi$1.80, ph$1.80 PB 136 459

Contents:
Conductivity experiments
The resistivity and the temperature coefficient determination with bismuth
The conductivity of La, Ce, Pr and Nd hydrides
Dispersions of the rare-earth hydrides in mercury
The YbH_2-mercury system
The calcium hydride-mercury system
Further work on the $LaH_{2.8}$-mercury dispersion
A nuclear magnetic resonance investigation of $LaH_{2.8}$ and $CeH_{2.7}$

Watertown Arsenal Labs., Mass.
SOLUBILITY RELATIONSHIPS IN THE TITANIUM-HYDROGEN SYSTEM AND NON-STOICHIOMETRY OF TITANIUM HYDRIDE, by Arthur Kant. Technical rept. on Solubility of Gases and Solids in Transition Elements. May 58, 18p. 19 refs. Rept. no. WAL TR 54/1.
Order from LC mi$2.40, ph$3.30 PB 139 531

The stoichiometry of gamma-phase titanium is explained quantitatively by the assumption of equilibrium vacancies in an expanded titanium lattice. The heat of formation of TiH_2 (gamma phase) is calculated on the basis of the model to be -32.9 k.cal/mol.

Western Ontario U. (Canada).
COMBUSTION STUDIES OF ASTROPHYSICAL SIGNIFICANCE. III. SPECTROSCOPIC INVESTIGATIONS ON THE LUMINOUS CARBON MANTLE FOUND IN FUEL-RICH OXYACETYLENE FLAMES WITH PARTICULAR ATTENTION TO TEMPERATURE DETERMINATIONS, INTENSITY VARIATIONS AND THE C_3 RADICAL EMISSIONS, by G. V. Marr. Scientific rept no. 2 on Contract AF 19(604)1718. 1 Mar 57, 81p. 62 refs. AFCRC TN-57-202; AD-113 612.
Order from LC mi$4.80, ph$13.80 PB 136 217

Westinghouse Research Labs., Pittsburgh, Pa.
ELECTRICAL CLEANUP OF GASES, By J. H. Carmichael and J. S. Knoll. Rept. for Apr-June 58 on Contract AF 18(600)1049. 6p. Research rept. 71F191-R17.
Order from LC mi$1.80, ph$1.80 PB 136 138

Wisconsin U., Madison.
HYDROGEN BONDING OF PHENOLS TO OLEFINS, by Robert West. Rept. on Contract AF 49(638)285. 2 Sep 58 [14]p. 13 refs. AFOSR-TN-58-805; AD-202 360.
Order from OTS $0.50 PB 151 292

This paper reports infra-red studies of hydrogen bonding between hydroxl compounds and olefins in carbon tetrachloride solution. The infra-red absorption was observed in the 3000-3800 cm^{-1} region, near the fundamental O-H stretching frequency for the alcohols. The relative basicities of some olefins have been measured by determining the frequency shift on hydrogen bonding The basicities of olefins are increased by increasing alkyl substitution at the double bond, and decreased by conjugation. Olefins are stronger hydrogen bonding bases than simple aromatic hydrocarbons.

Columbia U., New York.
QUANTITATIVE ANALYSIS OF EROSIONAL TOPOGRAPHY, by Arthur N. Strahler. Final rept. on Contract N6onr-271(30). 15 Nov 57, 21p. 20 refs.
Order from LC mi$2.70, ph$4,80 PB 137 060

Complete and detailed disclosure of research completed under this project is made in 20 technical reports. Also included are abstracts of these reports, together constituting a detailed summary of the principal findings.

Maryland U., College Park.
THE HINTERLAND RELATIONS OF THE PORTS OF HALIFAX AND SAINT JOHN, by Donald J. Patton. Rept. no. 1 on Contract Nonr-595(05). June 57, 45p. AD-135 459.
Order from LC mi$3.30, ph$7.80 PB 135 898

A discussion is presented of the historical and contemporary political and socio-economic factors affecting the hinterland relations with the ports of Halifax and Saint John. Each port's tributary area in North America is described as consisting of 3 discontinuous parts; the Maritime Provinces themselves, the populated sections of southern Quebec and particularly southern Ontario, and the grain producing lands of the Prairie Provinces. From east to west, these 3 hinterland areas become increasingly seasonal; that of southern Quebec and southern Ontario is mainly seasonal, while that of the Prairie Provinces is almost entirely so. To the seasonal diversion of St. Lawrence traffic through the Maritime ports are added increments of traffic stemming from the effects of factors on circulations in North America and in the North Atlantic. Tabulations are presented of the commodities exported and imported (foreign and coastwise) at Saint John and Halifax during 1953, 1954, and 1955.

National Research Council, Washington, D. C.
GEOPHYSICS AND THE IGY: PROCEEDINGS OF THE SYMPOSIUM AT THE OPENING OF THE INTERNATIONAL GEOPHYSICAL YEAR, by Hugh Odishaw and Stanley Ruttenberg, ed. Geophysical mono. no. 2. June 58, 212p. 191 refs.
Order from NRC $8.00 NRC pub. 590

Climatology and Meteorology

Air Force Cambridge Research Center, Bedford, Mass.
CLOUD BASE DETECTION BY AIRBORNE RADAR, by Ralph J. Donaldson, Jr. Apr 58, 25p. 5 refs. Air Force Surveys in Geophysics no. 97; AFCRC TN-58-236; AD-152 469.
Order from LC mi2.70, ph$4.80 PB 137 020

This survey discusses the conditions under which cloud bases can be detected by airborne radar from a position above the clouds, and the optimum radar wavelength to use.

Air Force Cambridge Research Center, Bedford, Mass.
THE EFFECTS OF SAMPLER SPACING ON BASIC ANALYSES OF CONCENTRATION DATA, by Duane A. Haugen. Jan 59, 17p. 4 refs. GRD Research Notes no. 7; AFCRC TN-58-651; AD-208 864
Order from OTS $0.50 PB 151 619

The effect of sampler spacing on concentration data is examined by means of Student's t-test using Project Prairie Grass diffusion data. It is concluded that the particular sampler spacing employed during Prairie Grass was sufficient to permit stable estimates of the arcwise concentration distribution parameters.

Air Force Cambridge Research Center, Bedford, Mass.
METHODS OF ARTIFICIAL FOG DISPERSAL AND THEIR EVALUATION, by Christian E. Junge. Sep 58, 30p. 25 refs. Air Force Surveys in Geophysics no. 105; AFCRC TN-58-476; AD-160 751.
Order from LC mi$2.70, ph$4.80 PB 138 778

An attempt was made to include all fog dispersal methods and suggestions whether tested or not. Some may have been overlooked; but the list is considered fairly complete, falling in classes of dispersal by heating, desiccation, mechanical means, and electrical means. Only the principal ideas and basic facts are given, and in those cases of impracticability, the reasons for being impractical are included. Experimental results and field tests are carefully listed; and essential facts and considerations are summarized, including conclusive remarks about the methods' applicational possibilities.

Air Force Cambridge Research Center, Bedford, Mass.
A NUMERICAL INVESTIGATION OF THE BAROTROPIC DEVELOPMENT OF EDDIES, by Manfred M. Holl. Dec 58, 106p. 10 refs. Geophysical Research Papers no. 61; AFCRC TR-58-276; AD-209 171.
Order from OTS $2.50 PB 151 620

This paper deals with the formation of eddies in a straight parallel or zonal flow and with the subsequent modification of the flow profile. The fluid is taken to be homogeneous and inviscid. Numerical analogues for the physical equations are developed in detail and are analyzed. The work begins with the linear theory of dynamic stability. Numerical analogues are developed to determine the evolution of perturbations, sinusoidal along the flow, which are initially prescribed with arbitrary wave number, amplitude, and tilt variations, and which are superimposed on arbitrary flows. These flows are straight-parallel and are unbounded, or are half-bounded or bounded by plane surfaces. Integrations are carried out for an

unbounded flow profile with an inflection point. Unstable perturbations are isolated and the unstable spectrum is determined. A numerical analogue for the finite-amplitude problem, by which one can study the transfer of energy from the mean flow to the eddy is then developed. The most unstable perturbation, linearly determined, is taken as a small but finite disturbance. The integration is carried out and reveals the continued growth of the eddy and the modification of the mean flow. This method of investigation with added lapse rate and compressibility is discussed as an approach to turbulence, and to the modification of wind shear and lapse rate by the developed eddies. The general problem of numerical analogues for integrations requiring finite time-steps is also briefly discussed.

Air Force Cambridge Research Center, Bedford, Mass.
THE ROTOR FLOW IN THE LEE OF MOUNTAINS, by Joachim Kuettner. Jan 59 [27]p. 16 refs. GRD research Note no. 6; AFCRC-TN-58-626; AD-208 862.
Order from OTS $0.75 PB 151 654

After a description of the rotor phenomenon an attempt is made to explain it by the hypothesis of the "heated pressure jump." The simple hydraulic jump theory, although very attractive in many respects, fails to account for the fact that the height of the roll cloud frequently exceeds that of the cap cloud (= "Föhnmauer") and that of the mountain wave generally reaches its most intense state in the early afternoon hours. Measurements made during the Sierra Wave Project in California show the effects of rapid ground heating near the foot of the mountain, thereby reducing the inversion on top of the ground layer through turbulent mixing. This removes part of the gravitational constraint on the air mass bouncing upwards in the hydraulic jump. Heating rates of 1°C per 2 miles ground path and reduction of the inversion by 50 percent are observed. If the jump is moderately high part of the energy is radiated away in a wave system ("undulatory jump"). If the jump is intense, up to 50 percent of the kinetic energy is transformed into turbulence ("breaking jump"). A diagram is given from which the height of the rotor can be estimated. The "breaking jump" seems to be identical with the most hazardous type of rotor. High cap cloud and strong heating tend to create dangerous conditions.

Air Force Cambridge Research Center, Bedford, Mass.
THERMAL TECHNIQUES FOR DISSIPATING FOG FROM AIRCRAFT RUNWAYS, by Currie S. Downie and Robert B. Smith. (Allied Research Associates, Inc.). Sep 58, 47p. 11 refs. Air Force Surveys in Geophysics no. 106; AFCRC TN-58-477; AD-160 752.
Order from LC mi$3.30, ph$7.80 PB 138 499

Several techniques for dissipating fog over aircraft runways when ambient temperatures are warmer than 25°F utilize large quantities of heat. A FIDO installation would be more reliable than other dissipation techniques, but would require a large capital investment. The use of exhaust heat from jet aircraft engines has been proposed as an alternative to FIDO, because of comparatively minor fixed installation costs and reduced operating costs. The utilization of jet aircraft has the added advantage of maximum flexibility and an emergency capability of all USAF bases having jet aircraft. At Thule Air Base, Greenland, a FIDO installation to clear 7500 feet by 300 feet by 200 feet vertically would represent a capital investment of perhaps $2,000,000 and cost about $150 per minute of operation. Using surplus jet aircraft, the capital investment would be about $300,000, exclusive of aircraft cost, while operating costs would be somewhat less than for FIDO.

Army Signal [Research and Development Lab.] Fort Monmouth, N. J.
SFERICS LOCATING SYSTEM AN/FMS-3(V), by Kenneth C. Steelman and W. G. Stone. 18 Sep 57, 61p. 5 refs. Engineering rept. no. E-1215.
Order from LC mi$3.90, ph$10.80 PB 137 106

The purpose of this report is to outline the design of a system to instantaneously determined the geographical location of the source of a "sferics signal". The azimuths or bearings are determined by Sferics Direction Finders at outlying stations and transmitted to a central or control station, where the origin of the signal is automatically plotted.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
SHOOTING-SPHERE ANEMOMETER, by Walter C. Conover. 1 Aug 58, 37p. 10 refs. USASRDL Technical rept. 1974.
Order from LC mi$3.00, ph$6.30 PB 136 585

An instrument has been investigated which measures the atmospheric wind profile by determination of the aerodynamic effects of the wind on a series of small spheres shot almost vertically into the air. Numerical integration of the equations of the spheres' trajectories was made and applied to the measurement of the wind profile. Comparison of measurements with this instrument to measurements of a series of Bendix-Friez Aerovanes on a 400-foot tower discloses comparable measurements of the same wind field.

Cloud Physics Lab., U. of Chicago, Ill.
RANDOMIZED SEEDING OF OROGRAPHIC CUMULI, 1957: PART II, by Louis J. Battan and A. Richard Kassander (U. of Arizona). Technical note no. 15 on Contract AF 19(604)1388. 1 June 58, 18p.
Order from LC mi$2.40, ph$3.30 PB 136 030

During July and August 1957, orographic cumuli over the Santa Catalina Mountains of southeastern Arizona were seeded from an airplane with silver iodide. The experimental design of the program involved the randomized seeding by pairs of days; one of two days with suitable clouds was seeded randomly. On 14 pairs of days, observations of the formation and spread of precipitation were made with a 3-cm height-finding radar. This report describes the analysis of these data. It appears that seeding caused some changes in the precipitation processes. On the seeded days, the initial echoes were on the average at a higher altitude (and lower temperature) and high rates of growth of the echo tops were more frequent than on

the non-seeded days. From the observations collected during 1957, one must conclude that the observed differences are not statistically significant. However they indicate the wisdom of continuing the program for at least one more year as has already been planned.

McGill U. (Canada).
PRESSURE-CONTOUR VARIANCE AND KINETIC ENERGY OVER THE ARCTIC, by W. L. Godson and M. A. MacFarlane. Scientific rept. no. 5 on Contract AF 19(604)1141. Mar 58, 77p. 16 refs. Archic Meteorology Research Group Pub. in Meteorology Research Group Pub. in Meteorology no. 7; AFCRC TN-58-248; AD-152 483.
Order from LC mi$4.50, ph$12.30 PB 136 425

This paper presents a study of the significance of the space variance of the 500 mb. height field over the arctic area. It seemed likely that the space variance of the height field would be related to the space-mean kinetic energy of the motion. The writers present an account of theory touching on this idea, and then submit both the theory and the idea to an empirical test.

Massachusetts Inst. of Tech., Cambridge.
STUDY OF THE AMPLITUDE DISTRIBUTION FUNCTION FOR RADAR ECHOES FROM PRECIPITATION. PART I: DISCUSSION OF OBSERVED AMPLITUDE DISTRIBUTION FUNCTIONS. PART II: DERIVATION OF AMPLITUDE DISTRIBUTION FUNCTIONS FOR GROUPS OF SCATTERERS IN RANDOM POSITIONS, by Pauline M. Austin, Technical rept. no. 17 on Weather Radar Research, Contract DA 36-039-sc-124 31 May 52, 41p. .6 refs.
Order from LC mi$3.30, ph$7.80 PB 136 008

Part I. Discussion of observed amplitude distribution functions. Part II. Derivation of amplitude distribution functions for groups of scatterers in random positions.

Quartermaster Research and Engineering Center, Natick, Mass.
CANAL ZONE ANALOGS II. ANALOGS OF CANAL ZONE CLIMATE IN INDIA AND SOUTHEAST ASIA, by Will F. Thompson. June 58, 57p. 24 refs. Technical rept. EP-91; AD-206 427
Order from LC mi$3.60, ph$9.30 PB 137 851

This report is the second of a series comparing the climate of tropical regions with that of Cristobal and Balboa Heights, Canal Zone.

Quartermaster Research and Engineering Center, Natick, Mass.
CANAL ZONE ANALOGS IV. ANALOGS OF CANAL ZONE CLIMATE IN WEST CENTRAL AFRICA, by Will F. Thompson. July 58, 55p. 11 refs. Technical rept. EP-93; AD-201 152.
Order from LC mi$3.60, ph$9.30 PB 137 369

The results of climatic testing in the Canal Zone may be applied with considerable confidence to much of the northern shore of the Gulf of Guinea. The climate of the coast is closely analogous to that of either the Atlantic or Pacific side of the Canal Zone except for the western part of the Bight of Benin. Close analogy to Cristobal, representing the wetter, windward, Atlantic side of the Canal Zone, is found in the wetter parts of the study area at the head of the Bight of Biafra and seaward of the Guinea Highlands. Close analogy to Balboa Heights, representing the drier, leeward, Pacific side of the Canal Zone, occurs on the east side of the Guinea Highlands, on the coast between the Guinea Highlands and the west side of the Bight of Benin, on the eastern shore of the Bight of Benin, on the upper Niger delta, and on the southern and eastern sides of the Cameroons-Gabon Plateau. Analogy with the various single elements mapped in this study is generally coastal in distribution, extending north in this study is generally coastal in distribution, extending north in some instances to cover the sudan. The Atlantic coast of the Sahara and certain Saharan uplands are analogous only for temperature of the warmest month; otherwise, the Sahara is not analogous.

Quartermaster Research and Engineering Center, Natick, Mass.
CANAL ZONE ANALOGS V. ANALOGS OF CANAL ZONE CLIMATE IN SOUTH CENTRAL AFRICA AND MADAGASCAR, by Walter Beale Blair. July 58, 61p. 26 refs. Technical rept. EP-94; AD-202 287.
Order from LC mi$3.90, ph$10.80 PB 136 885

The climate of South Central Africa and Madagascar is compared with that of two localities in the Canal Zone: Balboa Heights, representing the drier, leeward, Pacific side of the Isthmus of Panama, and Cristobal, representing the wetter, windward, Atlantic side. Distribution of areas of analogy of pertinent climatic elements and combinations of these elements are shown on maps. The only area in South Central Africa that is analogous to either of the Canal Zone stations is the outer periphery of the Congo Basin, north of 7° S latitude and westward to the Atlantic Ocean; it is analogous to Balboa Heights. This analogous area does not have as much rainfall as Cristobal. Some of the higher areas which are analogous to Balboa Heights in precipitation are too cold for temperature analogy. The area of analogy for the mean temperature of the warmest month is much larger than the area of analogy for the mean temperature of the coldest month. The study area has greater mean daily ranges of temperature than the Canal Zone. An area in the most continental and equatorial part of the Congo Basin is not analogous because of too many wet months. For mean cloudiness of the wettest month and relative humidity of the driest month, analogy appears to exist between the Canal Zone and much of the study area, but not enough data are available to draw firm conclusions.

Quartermaster Research and Engineering Center, Natick, Mass.
CANAL ZONE ANALOGS VI. ANALOGS OF CANAL ZONE CLIMATE IN SOUTH AMERICA, by Will F. Thompson. Sep 58, 58p. 23 refs. Technical rept. EP-97; AD-206 428
Order from LC mi$3.60, ph$9.30 PB 137 857

This report is the sixth of a series comparing the climate of Cristobal and Balboa Heights, Canal Zone, with other tropical regions of the world.

Texas A. and M. Coll., College Station
A PRELIMINARY REPORT ON THE DESIGN OF A COMPUTER FOR MICROMETEOROLOGY, by M. H Halstead, Robert L. Richman and others. Scientific rept. no. 1 on Contract AF 19(604)1117. June 56, 66p. 55 refs. Ref. 57-9T; AFCRC TN-56-670; AD-98 731.
Order from LC mi$3.90, ph$10.80 PB 135 581

Since all micrometeorological parameters must be uniquely determined by the macrometeorological parameters and the characteristics of the underlying surface, it should be possible to predict the former from a knowledge of the latter two. Unfortunately, both a lack of knowledge and the extreme complexity of the interrelationships involved have deferred the solution of this problem. The present report describes an attempt at a solution for the simple case of a large plain, and gives in detail the physical relationships, the empirically determined constants, and the physical mechanism employed, together with a discussion of limitations of the present equipment.

Wisconsin U., Madison.
NORMAL 500 mb CHARTS FOR THE NORTHERN HEMISPHERE: ANNUAL, SEASONAL AND MONTHLY STANDARD DEVIATIONS AND DATA LISTS, by Reid A. Bryson, James F. Lahey and others. Scientific rept. no. 8 on Contract AF 19(604)922. Nov 57, 40p. AFCRC TN 58-404; AD-152 531.
Order from LC mi$3.00, ph$6.30 PB 138 688

A method is presented by which new 500-mb normals are constructed directly from the punching of a card deck of 500-mb heights at grid points over the northern hemisphere. The punching was done from carefully reanalyzed charts for October 1945 through January 1953. Heights were taken from the charts at longitudes and latitudes which end in 0 and 5. The number of daily heights contributing to the monthly mean for each grid point varied from 198 to 248. The seasonal means are computed from the sum of all days within the season rather than from an unweighted sum of the monthly means. Standard deviations from the mean monthly 500-mb values were computed for all grid points.

Wolf, William M., Co., Boston, Mass.
STATISTICAL DETERMINATION OF WIND AND AIR DENSITY FROM AIRCRAFT FLIGHT CHARACTERISTICS, by Richard F. Jenney, Albert V. Shortell, Jr., and William M. Wolf. Addendum to Final rept. on Contract AF 19(604)2236. 1 Aug 58, 98p. 14 refs. AFCRC TR-58-181; AD-160 827.
Order from LC mi$5.40, ph$15.30 PB 136 389

This report is submitted to the Air Force Cambridge Research Center by the William M. Wolf Company as the final report under Supplemental Agreement No. 2, Contract No. AF19(604)2236. The report presents a statistical analysis of winds, air densities, and errors with the result that winds and air densities at several altitudes may be determined from the flight paths of aircraft. The results of the analysis are incorporated into flow diagrams of the digital computer system which was designed to perform the functions of the existing analog computer air traffic control system, AN/GSN-3 (XD-1) (VOLSCAN). The proposed digital computer system was first described in the Final Report under Air Force Contract No. AF19(604)2236, dated December 16, 1957, and has been modified only to the extent that the wind and air density are considered differently.

Frost Science

Army Snow Ice and Permafrost Research Establishment, Wilmette, Ill.
EFFECTS OF EXPLOSIVES ON SNOW, by Alfred Fuchs. July 57, 13p. 2 refs. Special rept. 23.
Order from LC mi$2.40, ph$3.30 PB 136 839

As avalanche control by explosives is used more and more in the United States, it becomes necessary to study all the problems connected with this work, in order to provide the snow ranger with well developed equipment, effective and economic explosives, and clear instructions.

Naval Civil Engineering Lab., Port Hueneme, Calif.
SQUAW VALLEY WINTER TRIALS 1957-58 COMPACTED SNOW PARKING LOT STUDY, by J. E. Dykins, R. C. Coffin, Jr., and E. H. Moser, Jr. 15 Sep 58, 40p. 4 refs. Technical rept. R-009.
Order from LC mi$3.00, ph$6.30 PB 137 880

The study was to determine the effects of vehicle trafficking on a compacted-snow parking lot and to develop maintenance techniques. Using conventional snow-compaction equipment, a small parking lot was built in mid-February 1958 on a 5-ft snow pack overlaying well drained flat terrain in Squaw Valley. Between 8 to 23 March, private cars and interstate busses used the lot on six occasions for all-day parking. Maintaining an adequate surface for traffic during heavy rains, long warm spells, high solar radiation, and new snowfalls was the most critical problem encountered. It was found that a 1/2-in. surface cover of sawdust preserved the compacted-snow mat during rain storms, warm spells, and periods of high solar radiation. Furthermore, the sawdust contributed to better traction and safe-driving conditions. Recovery of the lot following snowfalls required a varying effort, and setup time ranging from one hour to a full day, depending upon the depth of new falls and ambient temperatures.

Geodesy

[Air Force Missile Test Center, Patrick AFB, Fla.]
TRANSFORMATION OF COORDINATES ON THE EARTH'S SURFACE, by Bruce U. Glass. [1956] 12p. RCA Technical memo. no. 100-1; AD-122 671.
Order from LC mi$2.40, ph$3.30 PB 136 413

Given the latitude and longitude of two points and their heights above the earth's surface, these points are choosen as centers of right handed rectangular coordinate systems with the normals to the surface at the points forming the Z axes and with the X and Y axes lying in the tangent plane such that the Y axes point north. Assuming the earth's surface is sufficiently approximated by Clarke's Spheroid of 1866, this memorandum contains a method by which the coordinates of any point in one system can be uniquely expressed as coordinates in the other system.

Army Engineer Research and Development Labs., Fort Belvoir, Va.
INVESTIGATION AND EVALUATION OF PLANIGON LENS DISTORTION CHARACTERISTICS, by S. J. Friedman. 14 Feb 57, 30p. Technical rept. 1472-TR.
Order from LC mi$2.70, ph$4.80 PB 137 397

The Corps of Engineers have a requirement for aerial mapping photography which is free from distortion due to the aerial camera lens. As a result of post-war development, a nominally distortion-free lens was successfully designed, and the Air Force contracted for 112 mapping cameras to be equipped with such lenses. The calibration data on these cameras were analyzed and evaluated by ERDL. A limited engineering test, consisting of evaluation of serial mapping photography taken with two cameras selected from the group, was made. One camera was characterized as highly desirable based upon its calibration data; the other was judged to be a potentially poor camera. Photography taken under identical conditions was evaluated, and it was found that theoretical performance predictions were closely realized in practice.

Oceanography

Chesapeake Bay Inst., Johns Hopkins U. [Annapolis, Md.]
INDUCTION CONDUCTIVITY INDICATOR. A NEW METHOD FOR CONDUCTIVITY MEASUREMENT AT SEA, by Gerald L. Esterson. Rept. on Contracts Nonr 248(20) and Nonr-248(30). Mar 57, 185p. 106 refs. Technical rept. 14; Reference 57-3.
Order from LC mi$8.40, ph$28.80 PB 136 122

This dissertation presents the analysis of such a system for conductivity measurements as applied particularly to sea water. A study of the successful current-transformer system devised by the writer for the measurement of the secondary current is included in the analysis. The final experimental model of the complete system is described in some detail and conductivity data obtained with it are given along with an evaluation of the merit of the instrument.

Navy Electronics Lab., San Diego, Calif.
A TEMPERATURE-CONTROLLED TANK FOR CALIBRATING REVERSING THERMOMETERS, by J. S. Black. 6 May 57, 12p. NEL/Rept. 784.
Order from LC mi$2.40, ph$3.30 PB 138 004

Develop a controlled-temperature tank for calibrating deep-sea reversing thermometers and other precise temperature-measuring instruments. A 70-gallon controlled-temperature tank has been constructed and tested. The temperature can be reproduced and held to ±0.002°C over the range —3°C to 40°C. The tank's large size and remote operation permit calibration of 24 reversing thermometers at one time. It eliminates tedious calibration data reduction, since both main and auxiliary thermometer stems are read at temperature of reversal.

New York U. Coll. of Engineering, N. Y.
DEVELOPMENT OF A CAPACITY PROBE FOR MEASURING CAPILLARY WAVES, by John J. Stalder. Technical rept. on Contract Nonr-285(26). Sep 57, 35p.
Order from LC mi$3.00, ph$6.30 PB 135 714

A system employing immersed capacity probes has been developed for measurement of wave heights. This system is capable of determining the relative motion between probe and water over a range of amplitudes from .010 to 1.5 inches (peak to peak) and at frequencies from 1 to 60 cycles per second. The limits of amplitude and frequency capability have not been established.

Physics of the Atmosphere

Army Signal Research and Development Lab., Fort Monmouth, N. J.
HIGH ALTITUDE RADIOSONDE FLIGHTS, JANUARY 1955, PART II, by Marvin Lowenthal and A. Arnold. 28 Apr 58, 74p. 14 refs. USASRDL Technical rept. 1962.
Order from LC mi$4.50, ph$12.30 PB 138 430

Upper air data from five locations, Patrick AFB, Florida; Belmar, New Jersey; Chanute AFB, Illinois; Goose Bay, Labrador; and Narssarssuak, Greenland are analyzed for the month of January 1955. An abrupt change in the stratospheric winds occurred near the middle of the month. The two wind regimes are analyzed and discussed. The synoptic situation leading to the monsoon change is described. Mean stratospheric temperatures and winds are shown and the seasonal differences discussed. Within the limits of the available data, diurnal variations in temperatures are described. Diurnal variation of the winds could not be ascertained at this time.

Army Signal [Research and Development Lab.] Fort Monmouth, N. J.
SIGNAL CORPS-AIR WEATHER SERVICE HIGH-ALTITUDE RADIOSONDE FLIGHTS, JULY 1955, PART III, by Marvin J. Lowenthal. 10 dec 57, 112p. Technical memo. no. M-1933.
Order from LC mi$6.00, ph$18.30 PB 138 429

The purpose of this report is to present a concise analysis of meteorological data for July 1955 for various geographic locations in North America. From the data, important aspects of the general atmospheric circulation are pointed out.

Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
INTERSTATE ATMOSPHERIC TRANSPORT OF TRACER PARTICLES IN THE N. Y. -N. J. METROPOLITAN AREA, by William H. Megonnell. Jan 58, 119p. 6 refs. Technical rept. A58-6.
Order from LC mi$6.00, ph$18.30 PB 137 824

The purpose of this project was to investigate the interstate transport of air pollutants in the New York-New Jersey area. Small amounts of an identifiable simulated atmospheric pollutant (fluorescent zinc cadmium sulfide tracer material) were released in one State and recovered in the other. In Phase I, the tracer was dispersed in the air at various points in New Jersey and was recovered in Staten Island. In Phase II, the material was released in Manhattan and collected in New Jersey.

ENGINEERING

Aeronautical Engineering

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
INTERIOR COLOR SCHEMES FOR AIRCRAFT GRAY INSTRUMENT PANEL, by James M. Vanderplas. Rept. on Visual Requirements of Aircraft Lighting Systems. June 53, 11p. Technical note WCRD 53-71; ATI-203 286.
Order from LC mi$2.40, ph$3.30 PB 138 181

This report constitutes a discussion of visual adaptation factors affected by the use of gray as a color for aircraft instrument panels. A summary and discussion are presented of considerations, evolved at recent mock-ups and conferences at the Wright Air Development Center, of factors of aircraft instrument panel brightnesses as they affect instrument reading and exterior visibility. It is concluded on the basis of these considerations that a gray color, number 3520 in Federal Specification TT-C-595 is suitable as a color for instrument panels from the standpoint of visual adaptation requirements.

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
OPTIMUM FILLING OF LIQUID OXYGEN CONVERTERS, by C. A. Gibson. Nov 58, 7p. WADC Technical rept. 58-552; AD-206 910.
Order from OTS $0.50 PB 151 626

Tests were conducted using combination fill-buildup-vent valves in filling liquid oxygen converters. The converters were connected for filling to simulate, as nearly as possible, the aircraft connections in servicing aircraft in the field. This series of tests indicated that the optimum filling condition of liquid oxygen converters is obtained when a combination fill-buildup-vent is used to control flows of oxygen in the converter fill and buildup circuits.

Aeronautical Electronic and Electrical Lab., Naval Air Development Center, Johnsville, Pa.
HEAT TRANSFER STUDIES, by A. R. Saltzman and B. T. Plizak. Final rept. on TED Proj. no. ADC EL-41002, Test 25. 17 Jan 56, 156p. 15 refs. Rept. no. no. NADC-EL-5557.
Order from LC mi$7.50, ph$24.30 PB 137 423

Test 25 of TED Project No. ADC EL-41002 was established by reference (a) for the purpose of conducting heat transfer studies on existing naval airborne electronic equipment to determine methods most suitable for reducing component temperatures by improving equipment thermal design.

Air Force Cambridge Research Center, Bedford, Mass.
DEVICE FOR LOWERING LOADS FROM HIGH-ALTITUDE BALLOONS, by W. C. Wagner and F. X. Doherty. July 58, 22p. Instrumentation for Geophysics and Astrophysics no. 8; AFCRC TR-58-240; AD-152 583.
Order from LC mi$2.70, ph$4.80 PB 137 893

A device for lowering loads from high-altitude balloons has been developed under Project 6665 "Balloon Components," a project for the development of techniques and experimental models of equipment which will make the large plastic balloon a more versatile and useful vehicle for the United States Air Force. This device has successfully met a requirement for a particular application to lower a 600-pound instrumented package to a distance of 500 feet below an ascending balloon. A 20-minute lowering time was allowed with the restriction that shock loading be no greater than 3 g's. The device developed is of such a nature that through simple design modifications, it can very readily be adapted to accommodate different combinations of load, length of line, and time periods of lowering. With the automatic decrease in torque as line is deployed and consequently the decrease in speed of lowering as torque decreases, shock-loading effects are virtually eliminated. Thus the device is ideally suited for the lowering of payloads, such as delicate instruments, from a flying balloon.

Air Force Cambridge Research Center, Bedford, Mass.
HAZARDS OF LIGHTNING DISCHARGE TO AIRCRAFT, by G. A. Faucher and H. O. Curtis. Aug 58, 28p. 20 refs. Air Force Surveys in Geophysics no. 103; AFCRC TN-58-424; AD-152 595.
Order from LC mi$2.70, ph$4.80 PB 136 879

This Survey contains a discussion of the thunderstorm and its electrical structure; an explanation of the process and types of lightning discharge; an assessment of the damage resulting from lightning discharge to aircraft and a description of the mechanism for this discharge; and an evaluation of the hazards of refueling aircraft during periods of high electric fields plus recommendations for safe procedures. Also, the recommendations of the Lightning and Transients Research Institute for aircraft protection against lightning damage are summarized.

Air Force Cambridge Research Center, Bedford, Mass.
AN OPERATIONAL SYSTEM TO MEASURE, COMPUTE AND PRESENT APPROACH VISIBILITY INFORMATION, by Thomas O. Haig and William C. Morton, III. June 58, 140p. 3 refs. Air Force Surveys in Geophysics no. 102; AFCRC TN-58-417; AD-152 584.
Order from LC mi$6.90, ph$21.30 PB 138 428

The history and major effects of the Approach Visibility Project (ANDB) are reviewed briefly. The development of a simplified system to determine visual contact height is discussed in detail. The use of this information in military and civil air operations is discussed, and instructions for implementing the system on an interim basis are presented.

Armour Research Foundation, Chicago, Ill.
DETERMINATION OF EMISSIVITY AND REFLECTIVITY DATA ON AIRCRAFT STRUCTURAL MATERIALS, by O. Harry Olson and James C. Morris. Rept. on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3002. Oct 58, 39p. WADC Technical rept. 56-222, Part 2, Suppl. 1; AD-202 494.
Order from OTS $1.00 PB 151 604

Total normal emissivity data are presented for a list of materials which could not be measured with the equipment described in the main body of the report. Instead they were measured with equipment developed subsequently to handle refractories and glasses. In the former, samples were heated by conduction heating in vacuum, in the latter, samples were heated in a tubular furnace in air. Spectral Reflectivity curves from 0.3 to 2.7 microns are presented for a list of materials and their solar absorptivity values have been calculated. (See also PB 151 603)

Armour Research Foundation, Chicago, Ill.
DETERMINATION OF EMISSIVITY AND REFLECTIVITY DATA ON AIRCRAFT STRUCTURAL MATERIALS. PART II: TECHNIQUES FOR MEASUREMENT OF TOTAL NORMAL EMISSIVITY, NORMAL SPECTRAL EMISSIVITY, SOLAR ABSORPTIVITY AND PRESENTATION OF RESULTS, by Howard T. Betz, O. Harry Olson and others. Rept. for May 56-May 57 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3002. Oct 58, 197p. 9 refs. WADC Technical rept. 56-222, Part 2; AD-202 493.
Order from OTS $3.00 PB 151 603

Equipment has been designed, constructed and calibrated for the measurement of total normal emissivity in the range -300°F to +3000°F. The procedure consists in comparing the total normal radiance of a sample to that of a comparison blackbody, the ratio of the signals being taken as the emissivity. A thermistor detector is used in conjunction with a folded optical system to record the radiation which is chopped at 16 cps. The normal spectral emissivity values are obtained by an optical pyrometer method which makes use of the relationship between the true temperature of a sample to its apparent brightness temperature. A Leeds and Northrup disappearing filament pyrometer is used to make the necessary measurements. An integrating sphere reflectometer is used to measure spectral reflectivity in the wavelength range, 0.3 to 3.0 microns. A General Electric Recording Spectrophotometer is used for the visible range and an apparatus of our own design for the ultraviolet and infrared. The latter employs a Perkin-Elmer monochromator, a comparison type integrating sphere, and a lead sulfide cell detector. Spectral reflectivity data are combined with solar spectral energy data to determine solar absorptivity at sea level and above the earth's atmosphere.

Bureau of Aeronautics, Dept. of the Navy, Washington, D. C.
PILOTED AIRCRAFT FLIGHT CONTROL SYSTEM SYMPOSIUM [NO. 2] 25 June 52. [1952] 167p. 18 refs. BUAER rept. AE-61-5-III.
Order from LC mi$7.80, ph$25.80 PB 139 608

Contents:
Centering characteristics of power boosted aircraft control systems (Martin)
Helicopter powered control system problems (Sikorsky)
Flight research on force wheel control (WADC)
An analysis of fully-powered aircraft control systems including some reference to flutter theory (Northrop)
Parameters for the design of high-speed hydraulic servomotors (NACA)
Improvement of power surface control systems by structural deflection compensation (Boeing)
A survey of suggested mathematical methods for the study of human pilot's response (Franklin)
Synthesis of flight control systems (Purdue)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
MEASUREMENTS OF THE AERODYNAMIC HINGE MOMENTS OF AN OSCILLATING FLAP AND TAB, by T. C. Andreopoulos, H. A. Cheilek and A. F. Donovan. Rept. on Contract W33-038-sc-14248. Apr 49, 161p. 16 refs. USAF Technical rept. no. 5784; ATI-67 673.
Order from LC mi$7.80, ph$25.80 PB 139 292

The first phase of this investigation consisted of measuring in a wind tunnel the oscillatory aerodynamic moment coefficients about the flap and tab hinge lines for a two dimensional flap-tab combination undergoing sinusoidal oscillations. The reduced velocity range was from 0.5 to 3.75. The flap or tab was driven by a mechanical oscillator at various airspeeds and frequencies. The oscillatory aerodynamic moment coefficients were obtained by means of strain gage apparatus which measured only the oscillatory air moments. Mass coupling and elastic coupling and were eliminated by proper mass balance and by conducting tests at the natural frequency of the flap or tab. The test results showed that the experimental flap moment due to flap oscillations and the tab moment due to tab oscillations were in good agreement with theory. The tab moment due to flap oscillations and the flap moment due to tab oscillations showed poorer agreement with theoretical results. The second phase of the subject investigation consisted of using the model to obtain flutter test points. The experimental flutter data obtained were compared with corresponding theoretical data based on both theoretical and experimental oscillatory

moment coefficients. In general, flutter analyses based on experimentally derived moment coefficients predicted the critical flutter velocities with greater accuracy than corresponding analyses based on theoretical coefficients.

Guggenheim Jet Propulsion Center, Calif. Inst of Tech., Pasadena.
EXPERIMENTAL DETERMINATION OF THE STABILITY CURVES FOR AN INCLINED-JET FLAMEHOLDER, by M. J. Moore and A. E. Fuhs. Technical rept. no. 25 on Contract DA 04-ORD-446. July 58, 9p. AD-137 113.
Order from LC mi$1.80, ph$1.80 PB 136 043

The stability curves (blowout velocity as a function of equivalence ratio) for a propane-air flame held stationary in a circular duct by two inclined jets were determined. The angle of inclination of each jet was 17° from the flow direction of the main stream. The parameters varied were jet pressure and jet composition. For the same operating conditions, a pair of inclined jets does not stabilize a flame as effectively as a single jet on the axis of the duct.

Institute of Aviation, U. of Illinois, Urbana.
TRAINING EVALUATION OF AN INSTRUMENT PANEL HOMOGENEOUS WITH RESPECT TO THE PRINCIPLE OF THE MOVING PART, by Robert C. Houston and M. R. Green. Rept. on Contract AF 33(616)3000. Nov 57, 66p. 31 refs. WADC Technical rept. 57-551; AD-142 241.
Order from OTS $1.75 PB 131 660

Twenty flight-naive student pilots were trained in a modified Link trainer to fly ILS approaches in a C-47 under simulated instrument conditions. Ten students were trained using an experimental panel in which the moving indices consistently represented the aircraft's performance, and ten were given identical training on a conventional panel. Six subjects in each group flew the C-47 on ILS approaches under simulated instrument conditions. Analysis of the objective records of performance obtained during ground training and in the air shows that the group trained on the experimental panel performed in a significantly superior manner.

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
AIR RESEARCH AND DEVELOPMENT COMMAND TECHNICAL SYMPOSIUM, 9-10 JULY 1958, STATLER-HILTON HOTEL, DALLAS, TEXAS. Dec 58, 502p. WADC Technical rept. 58-655.
Order from OTS $7.00 PB 151 627

Contents:
Propulsion materials
Structural materials
- Aluminum and magnesium
- Beryllium
- Adhesive bonding materials
- Ceramics and cermets
- Fuels
- Graphites
- Refractory metals
- Reinforced plastics
- Steels
- Super alloys
- Surface treatment and coatings
- Titanium

Special purpose materials
- Composite materials
- Elastomers
- Fluids
- Glasses and dome materials
- Lubricants
- Transparent plastics
- Shielding
- Shock and vibration absorption
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Electronic materials
- Electronic synthesis and application
- Energy transforming materials
- Insulation and dielectric materials
- Magnetic materials
- Transistor materials

Materials research
- Basic research in Europe
- Internal structure and properties of matter
- New synthetic methods
- Structure and properties of interfaces
- Theoretical and experimental techniques in research

Materials application and processes
- Exploratory design
- Forging, extruding and rolling
- Forming, pressing and molding
- Joining
- Materials information services
- Melting and casting
- Non-destructive testing
- Surface treatment and chemical processing
- Unique evaluation facilities and techniques

National Advisory Committee for Aeronautics, Washington, D. C.
HYDRODYNAMIC IMPACT LOADS ON 30° AND 60° V-STEP PLAN-FORM MODELS WITH AND WITHOUT DEAD RISE, by Philip M. Edge, Jr., and Jean P. Mason. Sep 58. 20p. 11 refs.
Order from NASA NACA TN-4401

Tests were made at the Langley impact basin with models having round keels, straight intermediate sections, and chine flare. These tests were made in smooth water at fixed trims over a range of landing conditions at a beam-loading coefficient of 3.6. The data of the two models are compared to show effects of plan-form angle on impact loads, and the 30° V-step data are compared with data for the flat-bottom model (NACA Technical Note 2932) to show dead-rise effects for the V-step configuration.

National Advisory Committee for Aeronautics, Washington, D. C.
AN INVESTIGATION OF SOME PHENOMENA RELATING TO AURAL DETECTION OF AIRPLANES, by Harvey H. Hubbard and Domenic J. Maglieri. Sept 58. 49p. 11 refs.
Order from NASA NACA TN-4337

Conventional noise-level measurements consisting of broad- and narrow-band frequency analyses were

made for static ground tests of an unmodified and modified single-engine airplane. Also, listening data with the aid of ground observers were obtained in flight during cruise as well as for take-offs, landings, and power-off glides. The test results indicate that the external noise-level characteristics of the airplane, the propagation phenomena relating to the conditions of the problem, and the ambient or background noise conditions at the location are all significant factors in aural detection by ground observers.

National Advisory Committee for Aeronautics, Washington, D. C.
LIGHTNING HAZARDS TO AIRCRAFT FUEL TANKS, by J. D. Robb, E. L. Hill (Lightning and Transients Research Inst.) and others. Sep 58. 58p. 2 refs.
Order from NASA NACA TN-4326

The hazards of lightning strokes to aircraft fuel tanks were investigated in artificial-lightning-generation facilities constructed to duplicate closely the natural-lightning discharges to aircraft. There is a primary hazard whenever there is direct puncture of the fuel-tank wall, whereas the ignition of fuel by hot spots on tank walls due to lightning strokes is unlikely. Ninety percent of the natural-lightning strokes recorded have occurred in the temperature range of -10° to $+10^{\circ}$C, where many of the jet fuels are flammable but where aviation gasoline is overrich. Also, 10 percent of the strokes recorded have been to the wings, which are the principal fuel-storage areas for modern aircraft.

National Advisory Committee for Aeronautics, Washington, D. C.
LOW TIRE FRICTION AND CORNERING FORCES ON A WET SURFACE, by Eziaslav N. Harrin. Sep 58. 27p. 6 refs.
Order from NASA NACA TN-4406

An investigation was made by the National Advisory Committee for Aeronautics to study typical tire behavior on wet runways. A specially constructed tire treadmill served as a tire test vehicle whereas force measurements were made by means of a strain-gage balance. Values of maximum braking, full-skid braking, and rolling friction coefficients were obtained at yaw angles of 0° and 4° while operating two tire types (smooth and diamond treaded) in water depths from 0.02 to 0.09 inch and at speeds up to 94 feet per second including tire planing. Cornering-force coefficients were measured at the free-roll and maximum braking conditions.

National Advisory Committee for Aeronautics, Washington, D. C.
MEASUREMENTS OF THE MOTIONS OF A LARGE SWEPT-WING AIRPLANE IN ROUGH AIR, by Richard H. Rhyne. Sep 58, 22p. 8 refs.
Order from NASA NACA TN-4310

The results of a flight investigation of the angular and linear motions of a large swept-wing airplane in rough air for altitudes of 5,000 and 35,000 feet are summarized in the form of sample time histories, power spectra, root-mean-square values, and probability distributions.

National Advisory Committee for Aeronautics, Washington, D. C.
ORDINATES AND THEORETICAL PRESSURE-DISTRIBUTION DATA FOR NACA 6- AND 6A-SERIES AIRFOIL SECTIONS WITH THICKNESSES FROM 2 TO 21 AND FROM 2 TO 15 PERCENT CHORD, RESPECTIVELY, by Elizabeth W. Patterson and Albert L. Braslow. Sep 58. 99p. 2 refs.
Order from NASA NACA TN-4322

Information is presented with which ordinates can be easily obtained for any thickness from 2 to 21 percent chord for NACA 63-, 64-, and 65-series airfoil sections and from 2 to 15 percent chord for NACA 63A-, 64A-, and 65A-series airfoil sections. In addition, data required for estimation of the theoretical pressure distributions of any of these airfoils are included.

Ohio State U. Research Foundation, Columbus.
PREDICTED AND EXPERIMENTAL STRESSES IN SIMULATED SOLID PROPELLER BLADES, by C. T. West, E. C. Clark and others. Rept. on Contract AF 33(616)2124. Feb 56, 385p. WADC TR-55-122, Part 1; AD-90 693.
Order from LC mi$11.10, enl pr$60.00 PB 136 334

See also PB 119 907

Rosemount Aeronautical Labs., U. of Minnesota, Minneapolis.
THE MEASUREMENT OF HYPDERSONIC VELOCITIES AND ALTITUDES UP TO 300,000 FEET WITH A SELF-CONTAINED SYSTEM, by Robert L. Geronime and Lawrence D. Huppert. Rept. on Contract AF 33(616)3569. Sep 57, 82p. 35 refs. WADC Technical rept. 57-712; AD-142 177.
Order from LC mi$4.80, ph$13.80 PB 136 177

The problem of measuring altitude and velocity with a self contained system has been reviewed in detail. A study has been made of the errors which occur in measurement of pitot, static, and cone surface pressure in both the continuum and slip flow regimes.

2nd Weather Wing, Rhein-Main Air Base, West Germany.
COMPARISON OF THE ACCURACY OF NUMERICAL AND CONVENTIONAL PROGNOSTIC CHARTS AND THEIR VALUE AS FLIGHT PLANNING TOOLS, by Charles F. Roberts. Jan 58, 41p. Proj. no. WPB-108.
Order from LC mi$3.30, ph$7.80 PB 136 243

Daily 500mb prognostic charts prepared by the Joint Numerical Weather Prediction Unit for the period November 1956 - July 1957 are used to compute equivalent headwind components along four standard air routes across the North Atlantic and over western Europe. The errors in these route winds are com-

pared with those resulting from the use of conventionally prepared prognostic charts, persistence, and climatology as forecast tools. The growth of the wind error with time and route length obtained from each of these forecasts is examined for the purpose of determining at what point in time prognostic charts cease to have value as flight planning tools relative to the unskilled objective forecasts of persistence and climatology.

Technical Development Center, Civil Aeronautics Administration, Indianapolis, Ind.
EVALUATION OF MEANS ADOPTED TO PROVIDE FIRE PROTECTION IN B-36 AIRCRAFT POWERPLANTS, by Lyle E. Tarbell. Dec 58, 27p. 2 refs. Technical Development rept. no. 366.
Order from OTS $0.75 PB 151 520

A full-scale test program was conducted for the purpose of evaluating the fire-extinguishing system used in B-36 airplane powerplants and to assist in the design of an improved system. Certain design features of the powerplant which affected the control of inflight fires also were evaluated. Both laboratory and in-flight tests were made on the original and a number of revised extinguishing systems using an agent concentration recorder to determine the concentration and distribution of agent within the various fire zones. The quantity of agent discharged into each zone was determined from catch tests on a mocked-up system. The effectiveness of all fire control provisions ultimately was determined from laboratory tests in which actual fires were ignited in the powerplant under simulated flight conditions. Certain firewall improvements and a fire-curtain installation incorporated in B-36 aircraft by the Department of the Air Force were evaluated and found to be effective in preventing powerplant fires from spreading forward into the wing A revised extinguishing system which included Zone 3 coverage was found to be inadequate. Weaknesses in the fire seal separating Zones 1 and 3 and in the shrouding of hot surfaces in Zone 2 were indicated.

Technical Development Center, Civil Aeronautics Administration, Indianapolis, Ind.
EVALUATION OF THE FIRE-DETECTION AND -EXTINGUISHING SYSTEMS OF THE NAVY XP6M-1 AIRPLANE, by Joseph Osman. Nov 58 [19]p. Technical Development rept. no. 294.
Order from OTS $0.50 PB 151 513

This evaluation of the fire-detection and -extinguishing systems of the Navy XP6M-1 airplane was made using a steel mockup of the XP6M-1 nacelle and a dummy engine. The airflows for flight and surface-operating conditions were simulated during the tests. The fire-detection system was evaluated by igniting small test fires within the nacelle. The fire-extinguishing system was evaluated by conducting quantity and rate-measurement tests, by measuring extinguishing-agent concentrations during discharge of the system, and by full-scale fire-extinguishing tests. The original continuous detector system, with elements mounted circumferentially, was found to be ineffective in detecting test fires in the lower half of the nacelle; however, a continuous system, with its elements mounted longitudinally in the lower portion of the nacelle, proved to be effective in alarming these same test fires. Results of the evaluation tests of the fire-extinguishing system indicated that the system provided rapid discharge of agent, but its effectiveness in extinguishing fires was found to be marginal.

Thomson Lab., General Electric Co.
EVALUATION OF ALLOYS FOR HIGH TEMPERATURE GEAR APPLICATIONS, by E. G. Jackson, C. F. Muench and others. Rept on Metallic Materials, Contract AF 33(616)5266. Dec 58, 86p. 9 refs. WADC Technical rept. 58-546; AD-206 666.
Order from OTS $2.25 PB 151 625

The selection of materials for use in high Mach number aircraft gears requires consideration of high temperature physical, mechanical and chemical properties, and of rubbing compatibility. This program was designed to obtain bench test data on ten different materials for application as gears at operating temperatures to 700° F. Oils representing two important classes, silicone and mineral, were chosen for scoring tests. High temperature data were obtained on hardness, dimensional stability, tensile, impact and tooth fatigue strengths, corrosion and oxidation, and on surface scoring resistance. The most fatigue resistant material was Modified M50, Carburized, while Matrix M2 was the best of the through-hardened steels. In score resistance, the best material depended on the oil; L. P. D. (Vacuum), Nitrided was the best with silicone, but M1 rose from second place with silicone to first with mineral oil. Choice of material for any application must depend on whether tooth breakage or scoring is the limiting factor, however, the L. P. D. (Vacuum) Nitrided is the best compromise since it ranked high in all tests.

Chemical Engineering

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE EFFECTIVENESS OF ATROPINE BY VARIOUS ROUTES OF ADMINISTRATION IN THE RESUSCITATION OF DOGS EXPOSED BY INHALATION TO GB VAPOR, by Milton K. Christensen, Carl Umland, II and others. Aug 58, 9p. 6 refs. CWLR 2241.
Order from LC mi$1.80, ph$1.80 PB 137 801

The effectiveness of atropine by various routes of administration, together with artificial respiration by the mask-to-mask procedure, was evaluated in dogs exposed by inhalation for 1 minute to lethal concentrations of GB vapor. No significant difference in effective resuscitation could be demonstrated when atropine (5 mg./kg.) was administered by the intrapulmonary, intracardiac, intravenous, and intramuscular routes. Atropine by the intraperitoneal route was ineffective.

Army Chemical Warfare Labs., Army Chemical Center, Md.
IMPROVEMENT IN THE OZONE-AGING CHARACTERISTICS OF GR-S FACEBLANKS, by Milton Brill and Stanley R. Shuart. Jan 58, 28p. 4 refs. CWLR-2208.
Order from LC mi$2.70, ph$4.80 PB 137 357

An improved nontoxic recipe was developed. It was found that this compound could be molded easily in the M9 faceblank mold. The assembled faceblanks, when exposed to severe deteriorating conditions, were found to be useable after 4-mo. exposure. Faceblanks used as the control, were unuseable after 4-day exposure under the same conditions.

Chemical Corps Medical Labs., Army Chemical Center, Md.
CONTINOUS NITROGEN ANALYSIS IN THE MEASUREMENT OF GAS MASK LEAKAGE AND THE RATE OF ELIMINATION OF NITROGEN FROM THE BODY, by W. V. Blevins, H. Frankel and others. Sep 53, 23p. 10 refs. Research rept. no. 216.
Order from LC mi$2.70, ph$4.80 PB 135 956

The continuous nitrogen method of measuring leakage of the gas mask offers several advantages over the chemical (Scholander) method: The main advantage being that the nitrogen content of the respired air can be observed and recorded continuously throughout the test period, compared with the spot method of sampling employed with the Scholander apparatus. Another advantage is that the subject is allowed freedom of movement to perform exercises without interfering with the sampling technique. This method also affords a means of eliminating some of the possible errors encountered in using the Scholander method, such as improper rinsing of the sampling syringe, and the timing of the withdrawal of a sample to correspond to a particular phase of respiration. The accuracies of the two methods are comparable, that is on the order of one part per thousand.

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
FUNCTION AND NOMOGRAPH FOR ESTIMATING INTERFACIAL ENERGY FACTORS OF SURFACTANTS, by A. Mankowich. 14 July 58, 19p. 9 refs. Rept. no. CCL #60.
Order from LC mi$2.40, ph$3.30 PB 137 563

Civil Engineering

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
CREEP BUCKLING OF CURVED BEAM UNDER LATERAL LOADING, by T. H. H. Pian. Rept. on Contract Nonr-1841(22). Jan 58. 20p. 9 refs. Technical rept. no. 25-26.
Order from LC mi$2.40, ph$3.30 PB 139 334

Variational theorem for creep is applied to the problem of creep deflection of a curved beam under lateral loading. The end of the beam is restrained from sliding motion; hence under a static load it is possible to buckle suddenly from one equilibrium condition to another. It is shown that this abrupt buckling may also occur under the action of creep deformation. Both visco-elastic and nonlinear creep properties are included in the analysis.

[Army Engineer] Waterways Experiment Station, Vicksburg, Miss.
FIELD SONISCOPE TESTS OF CONCRETE, 1953 TESTS. Apr 54, 23p. 2 refs. Technical memo. no. 6-383.
Order from LC mi$2.70, ph$4.80 PB 136 695

Location of Reading Stations, Schedule of Testing, Apparatus and Test Method, Calculations and Results. The soniscope provides an approximate indication of concrete quality.

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
INITIAL LABORATORY AND FIELD TESTS OF QUICKLIME AS A SOIL-STABILIZING MATERIAL, by G. R. Kozan. Aug 58, 43p. 3 refs. Technical rept rept. no. 3-455, rept. 2.
Order from LC mi$3.30, ph$7.80 PB 136 562

Laboratory and field tests of quicklime were conducted to investigate its suitability as a soil stabilizer. Laboratory unconfined compression and cone penetrometer tests of a wet, soft clay treated with various amounts of quicklime were made to determine amount to use in the field tests. A test section, designed to have a 12-in.-thick quicklime-treated soil surface, was constructed on a lean clay subgrade having a cone index of approximately 20, and was traffic-tested with an M-51 truck loaded to 10,000 lb. These tests verified laboratory indications of the chemical's ability to stabilize soft soils. However, conventional equipment and techniques used to construct the quicklime-treated test section resulted in a stabilized surface of varying strength and thickness that did not meet trafficability requirements. It is recommended that laboratory research with quicklime be continued, and new or improved field mixing techniques be investigated.

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
REVIEW OF SOILS DESIGN, CONSTRUCTION AND PERFORMANCE OBSERVATIONS, TOM JENKINS DAM, OHIO, by R. C. Sloan. Mar 58, 44p. Technical rept. no. 3-474.
Order from LC mi$3.30, ph$7.80 PB 136 139

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
STUDIES OF AERIAL CONE PENETROMETER: LABORATORY STUDY OF MECHANICAL PRINCIPLES, by S. J. Knight. July 57, 33p. Technical rept. no. 3-462, rept. 1.
Order from LC mi$3.00, ph$6.30 PB 136 129

A specially designed spring-impact type penetrometer was built and shot from a compressed air gun into a container of soil. Penetrometer velocities and soil strengths were varied to cover a wide range of each. The initial data collected were used to determine relationships between the action of the penetrometer and the properties of the soil.

Army Snow Ice and Permafrost Research Establishment, Wilmette, Ill.
PROPOSED RELOCATION OF CAMP TUTO AND ACCESS ROAD, by Robert D. Leighty. Apr 58, 23p. Technical rept. 52.
Order from LC mi$2.70, ph$4.80 PB 138 228

A new location for Camp TUTO and an access road to the ice cap was selected by use of aerial photography and field checking. For this study a simplified soil classification system was designed, considering: broad grain size classification, the recognition of natural deposits in the field, the use of soil as borrow material and natural subgrade, and the general engineering problems concerned with frost action, permafrost, and moisture.

Bolt, Beranek, and Newman, Cambridge, Mass.
SOME MEASUREMENTS OF NOISE REDUCTION OF AIR BASE STRUCTURES, by R. M. Hoover and A. C. Pietrasanta. Rept. on Definition and Modification of Acoustic and Vibrational Environments, Contract AF 33(616)3938. Nov 58 [36]p. 5 refs. WADC Technical note 58-243; AD-208 156.
Order from OTS $1.00 PB 151 652

Measurements have been made of the noise reduction of exterior walls of an air base structure utilizing wood frame construction. Typical air base jet aircraft operations were used as noise sources. The results show that the noise reduction achieved by this type of construction, with operable sash windows occupying about 20 percent of the wall area, varies from 15 to 30 db. This is considerably less than would be predicted on the basis of wall weight alone, but it is shown that the noise reduction may be estimated correctly by assuming the existence of a distributed open area in the wall (cracks around windows) equivalent to 0.1% of the wall area. For open windows the measured data agree with estimates made considering the actual open area in the wall. Estimated and measured values for both open- and closed-window conditions agree within 1 or 2 db in the 150-300 and 300-600 cps octave bands, which are the most important bands for noise control design of air base offices.

Bureau of Yards and Docks, Washington, D. C.
CARPENTRY FORMULAS. Engineered Performance Standards, Public Works Maintenance. Mar 58, 168p.
Order from LC mi$7.80, ph$25.80 PB 139 128

Bureau of Yards and Docks, Washington, D. C.
CARPENTRY HANDBOOK. Engineered Performance Standards, Public Works Maintenance. Mar 58, 254p.
Order from LC mi$9.30, ph$31.80 PB 139 127

Bureau of Yards and Docks, Washington, D. C.
INTERIM ENGINEERS' MANUAL. Engineered Performance Standards, Public Works Maintenance. May 58, 230p. 13 refs.
Order from LC mi$9.90, ph$34.80 PB 139 126

Bureau of Yards and Docks, Washington, D. C.
MASONRY FORMULAS. Engineered Performance Standards, Public Works Maintenance. Aug 58, 78p.
Order from LC mi$4.50, ph$12.30 PB 139 129

Bureau of Yards and Docks, Washington, D. C.
MASONRY HANDBOOK. Engineered Performance Standards, Public Works Maintenance. Aug 58, 83p.
Order from LC mi$4.80, ph$13.80 PB 139 130

Minnesota U., Minneapolis.
DAMPING ENERGY DISSIPATED BY INTERFACES IN BEAM AND PLATE SUPPORTS AND IN SANDWICH CORES, by Theodore J. Mentel. Rept. for July 57 - June 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5426; Continuation of Contract AF 33(616)2803. Dec 58, 32p. 3 refs. WADC Technical rept. 58-547; AD-206 667
Order from OTS $1.00 PB 151 611

The maximum energy dissipation which can result from both viscous and dry friction damping between the longitudinal interfaces at the supports of built-in beams and plates is compared with the total material damping. This comparison shows that this type of support damping is relatively unimportant in the vibration attenuation problem for beams, but may be extremely important in the case of thin plates. An alternative method for the damping of beams, that of using sandwich construction with an energy dissipating central core, is found to provide an effective damping mechanism in the cases where support damping becomes ineffective.

Rome Air Development Center, Griffiss AFB, N. Y.
NOISE REDUCTION AIR FORCE CONTROL TOWERS by R. J. Christman. Oct 58, 47p. 4 refs. RADC TR-58-123; AD-202 092.
Order from LC mi$3.30, ph$7.80 PB 138 617

Recommendations are presented on the design of an Air Force Control Tower to provide for reduction of high-level airborne noise. Based upon noise spectra such as might be produced by J-79-equipped aircraft (e.g., F-104 or B-58) or rocket engines of the 130,000-pound thrust class, the recommendations are aimed at providing interior noise levels low enough to permit satisfactory verbal communications. Specific recommendations are included on the design of such tower features as the roof, windows, walls, doors, and floors.

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
TOGGLE SWITCHES: ACTIVATION TIME AS A FUNCTION OF SPRING TENSION, by Norman E. Stump. 5 Aug 52. 4p. Technical note WCRD 52-39; AD-61 598.
Order from LC mi$1.80, ph$1.80 PB 139 627

Ten subjects activated, as rapidly as possible, a toggle switch which was spring loaded to center. Spring loadings ranging from 220 grams to 1325 grams, were presented in a random order. Analysis of variance demonstrated that there were no significant differences in activation times between the loading conditions.

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
A COMPARISON OF AN ERROR-CORRECTING EIGHT-UNIT CODE WITH OTHER TELEPRINTER CODES FOR BINARY TRANSMISSION AND TERNARY RECEPTION, by Mary D. Lum. Jan 59 [45] p. 2 refs. WADC Technical Note 58-231; AD-203 123.
Order from OTS $1.25 PB 151 659

Teleprinter information is transmitted electrically using a sequence of "marks" and "spaces". A study is made of an eight-unit "four marks plus four spaces" binary code to determine whether the proposed eight-unit code is optimum with respect to character errors for various bit error rates, for binary transmission and ternary reception. Tables and graphs of the probability of character errors of different codes versus the proportion of bit errors for the range of 10% missing bits to 1% missing bits are given for two cases: (1) missing bits only; (2) 10% as many wrong bits as missing bits. The results indicate that the eight-unit double parity check code is definitely the best of the seven codes studied. However, the eight-unit "four marks plus four spaces" code and the seven-unit parity check code are nearly as good. The use of letter-figure shifts greatly increases the probability of a wrong character. The parity check codes are superior to the codes with constant number of marks and spaces in that they yield a smaller probability of character errors.

Air Force Cambridge Research Center, Bedford, Mass.
ACCURACY OF RDF POSITION FIXES IN TRACKING CONSTANT LEVEL BALLOONS, by Keith C. Giles and Roy E. Peterson (General Mills, Inc.) and William K. Widger, Jr., ed. Oct 58, 22p. 1 ref. Air Force Surveys in Geophysics no. 107; AFCRC-TN-58-481; AD-160 753.
Order from LC mi$2.70, ph$4.80 PB 137 793

Based on series of constant-pressure ballon flights that included concurrent tracking by standard radio direction-finding techniques and by camera techniques (which provided an accurate standard of true position), it has been possible to determine the distribution of errors in a significant sample of RDF fixes as made by networks manned by two different agencies. The comprehensive study of RDF fix error which is presented provides a sound basis for the use of such data.

Air Force Cambridge Research Center, Bedford, Mass.
THE DESIGN OF TROUGH WAVEGUIDE ANTENNA ARRAYS, by Walter Rotman and Sally J. Naumann. June 58, 49p. 12 refs. AFCRC TR-58-154; AD-152 427.
Order from LC mi$3.30, ph$7.80 PB 137 064

Several new types of linear antenna arrays that use trough waveguide as a transmission line have been investigated. The radiating elements of these fixed beam arrays can be discrete, continuous, or periodic; they can be resonant or nonresonant. Design criterions and mathematical analyses for trough waveguide traveling-wave line sources are presented for arrays with continuously and periodically asymmetric bases and for an array of resonant L-rod radiators. Antenna model studies of representative types show good agreement with theory. These trough waveguide arrays can easily be adapted to parallel-plate systems since the radiation occurs as TEM fields between bounding walls. Their other advantages over antenna systems that use conventional transmission lines, such as rectangular waveguides, include simpler mechanical construction, greater bandwidth, and better radiation characteristics.

Air Force Cambridge Research Center, Bedford, Mass.
AN INVESTIGATION OF THE RELIABILITY OF TACS/BADGE DIGITAL DATA TRANSMISSION OVER WHITE ALICE CIRCUITS, by William L. Arbuckle and Bruno R. Nesto. June 58, 23p. AFCRC TR-58-151; AD-152 423.
Order from LC mi$2.70, ph$4.80 PB 137 892

Analytic investigation of TACS/BADGE communication circuit requirements indicates that to pass TACS/BADGE data with a minimum acceptable mean time of 20 sec between errors, a communication circuit must have a bandwidth greater than 2 kcps and, depending on the amount of phase distortion present, a signal-to-noise ratio greater than 20 to 30 db. The effect of phase distortion on reliability is considered in detail.

Air Force Personnel and Training Research Center, Lackland AFB, Tex.
THE INFLUENCE OF CHART SCALE AND AMOUNT OF INFORMATION ON AIMING-POINT IDENTIFICATION BY EXPERIENCED SUBJECTS, by William H. Lichte, John G. Miller, and Clarence R. Borreson. Rept. on U. of Missouri, Contract AF 18(600)1209, Jan 58, 31p. 1 ref. AFPTRC TN-58-2; AD 152 111.
Order from LC mi$3.00, ph$6.30 PB 138 241

A series of charts varying in chart scale and amount of information was constructed for use with B-47 navigator subjects. After a chart-study period, subjects indicated target locations on 0-15 scope photographs.

This was done for four targets, at two distances, on Spokane and Kansas City. Charts with larger scales gave best performance. Level of information had no over-all effect, but further study is needed. Use of bold, larger-than-scale symbols for cultural features should be considered in preparing charts.

Air Force Personnel and Training Research Center, Lackland AFB, Tex.
STUDIES OF THE EFFECT UPON AIMING-POINT IDENTIFICATION OF CERTAIN CHART VARIABLES, by William H. Lichte. Rept. on U. of Missouri Contract AF 18(600)1209. Jan 58, 35p. 15 refs. AFPTRC TN-58-3; AD 152 112.
Order from LC mi$3.00, ph$6.30 PB 138 240

Exploratory study and three experiments were conducted to determine how scale, amount of information, and aspect-angle information of charts affected navigator performance as measured on use of 0-15 photographs by means of an aiming-point identification test and a new city recognition test. The data suggest that the navigator should have one small-scale (1:1,250,000) chart for navigational and orientational use and one large-scale (1:200,000) chart to aid in scope interpretation on the mission if the 5-inch scope is used. Use of aspect-angle information and amount of information should receive further study.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
ANTENNA PROPAGATION PROBLEM, by Herman Chernoff. Technical rept. no. 38 on Contract N6onr-251(40). 11 Oct 57; 16p.
Order from LC mi$2.40, ph$3.30 PB 136 464

Army Engineer Research and Development Labs., Fort Belvoir, Va.
VEHICULAR NAVIGATION BY INERTIAL SYSTEMS, by Chandler Stewart. 5 June 58, 18p. Technical rept. 1528-TR.
Order from LC mi$2.40, ph$3.30 PB 137 963

This report surveys the feasibility and possible advantage of applying inertial guidance principles to the navigation of ground vehicles. In order to determine if replacement of the present system by inertial components would result in improvements, an analysis was made of components that would be required and of the total position error that could be anticipated. Investigation and research revealed that certain limitations would be involved in an inertial system. These are: 1) To maintain an accuracy comparable with the present compass-odometer system, the vehicle would have to be stopped every minute for velocity reset; 2) The minimum weight that can be expected, considering current platform and compass developments, approximates 300 pounds; 3) The cost of producing an inertial system would approximate $40,000. In addition to these drawbacks, no means of reducing system cost to make it comparable with the $20,000 cost of the present system has been found; and substitution of accelerometers and platform, which account for the largest component errors would tend to increase the overall system error. It was therefore concluded that no advantage could be gained at this time in adopting an inertial system.

Army [Rocket and Guided] Missile Agency, Redstone, Ala.
PULSE DURATION MODULATED TRANSISTOR SWITCHES FOR D-C AMPLIFICATION, by D. L. Anderson, Niels Jasper, and James C. Taylor. 5 Mar 56, 21p. 11 refs. Rept. no. 1R12.
Order from LC mi$2.70, ph$4.80 PB 137 697

Research Report 1R12 covers basic design considerations of a d-c type amplifier. The circuit consists of a magnetic amplifier to transform a d-c signal amplitude into a series of pulses of constant repetition rate and a pulse duration which is proportional to the d-c signal. The magnetic amplifier output pulses are of sufficient height to operate a power transistor as a switch. The average value of the transistor load current is proportional to the magnetic amplifier control signal, and since the transistor is operated as a switch its load power may be several times its rated power. Several curves are given to show the upper power levels expected at this stage of transistor development.

Army [Signal Missile Support] Agency, White Sands Missile Range, N. Mex.
LABORATORY INVESTIGATION OF R-(XA-115)/ARW-62 RECEIVERS, SELECTOR, RADIO, by Merwin A. Olson and Gist E. Johnson. 5 Feb 58, 55p. AFC rept. #DC 5-2-58-RdeC.
Order from LC mi$3.60, ph$9.30 PB 137 664

Results are presented of a laboratory test of the R-(XA-115)ARW-62 Receiver, Selector, Radio. Operational characteristics such as sensitivity, selectivity, frequency drift, audio selectivity, audio characteristics, spurious responses, spurious emissions, VSWR of the antenna input and interference characteristics were examined. Spurious emissions were all found to be relatively low. Spurious responses were 60 db below the fundamental response except for several in the 1500 to 1600 MCS and 2500 to 2900 MCS range which were as sensitive as 32 db below the fundamental. A clear channel bandwidth of 600 KCS was required to protect the receiver from interference from J/S ratios up to 20 db. When FM interference using sustained tones on or close to the audio channel frequencies was tested, a clear channel bandwidth of 1700 KCS was required.

Army Signal Missile Support Agency, White Sands Missile Range, N. Mex.
LABORATORY INVESTIGATION OF WILLIAMS RS-1 (PROTOTYPE) RECEIVER, by H. G. Lassiter, V. Cisneros, and M. A. Olson. 30 July 58, 52p. AFC rept. TTC-30-7-58 RdeC.
Order from LC mi$3.60, ph$9.30 PB 137 833

Results of a laboratory investigation are given concerning the operational characteristics and spectrum utilization of a Williams Communication Service Receiver RS-1 (Prototype). Frequency stability, sensitivity, selectivity, spurious responses, modulation sensitivity, etc., were examined against parameters of simulated altitude, vibration, operating time, and variations in supply voltages. Frequency stability was within 0.016% except for vibration, wherein the frequency varied -0.16% to +0.01%. Eight (8) spurious responses not 70 db down from the fundamental response at 54.5 MCS were present within the

frequency range from 10 to 1000 MCS. One undesirable response, less than 5 db down, was located at approximately 65 KCS above the operating frequency. For simulated variations in altitude from 4,200 to 52,500 ft above sea level, the receiver sensitivity decreased 10 db (-97 dbm to -87 dbm).

Army Signal [Research and Development Lab.] Fort Monmouth, N. J.
DEVELOPMENTAL TRANSISTORS FOR V. H. F. AND U. H. F., by Victor Boxer. 1 Mar 57, 31p. Technical memo. no. M-1869; AD-130 329.
Order from LC mi$3.00, ph$6.30 PB 137 301

The recently developed diffused-base germanium transistors have opened the way toward ultra high frequency transistor circuitry. While these units are not yet in quantity production, they are being redesigned and fabricated in increasing numbers so that a careful consideration of these devices is in order. This report is an attempt to present the current status of developmental u. h. f. transistors, and emphasize the potential of these devices for oscillator amplifier work.

Battelle Memorial Inst., Columbus, Ohio.
COMPONENT EVALUATION AND SPECIFICATION ENGINEERING TEST DATA ON TASK XVIII. HIGH-FREQUENCY VIBRATION AND SHOCK TESTING OF RESISTORS, FIXED, POWER, WIREWOUND. Data taken Oct 54 - Feb 55 covering the products of the following manufacturers D, F, Z, AL, AN, AQ, and AR, Contract DA 36-039-sc-63136. [1955] 72p; AD-115 646.
Order from LC mi$4.50, ph$12.30 PB 136 462

Boston Coll., Chestnut Hill, Mass.
STUDY OF RESEARCH PROBLEMS CONCERNING NEGATIVE RESISTANCE DIODES. Final technical rept. for 1 Sep 56-1 Sep 57 on Contract AF 19(604)1926. Oct 57, 58p. AFCRC TR-58-153; AD-152 425.
Order from LC mi$3.60, ph$9.30 PB 135 214

Carnegie Inst. of Tech., Pittsburgh, Pa.
BUILD UP TIME OF PULSED OSCILLATORS, by James B. Woodford, Jr., and Leslie C. Hale. Final rept. for 30 Sep 55-30 Sep 56 on Contract AF 30(635)2802. Apr 57, 39p. 6 refs. RADC TR-57-86; AD-114 468.
Order from LC mi$3.00, ph$6.30 PB 135 257

The build-up time of pulsed oscillators has been observed often to exceed greatly that which is classically expected. The cause of this delay is investigated and methods of calculating the delay are developed for situations where: (a) The oscillator builds up from the circuit noise level because there is a negligible frequency component of the applied pulse at the oscillator frequency. (b) The oscillator builds up from the shock-excited level in the tuned circuit caused by the applied pulse and (c) Both of the effects (a) and (b) are important.

Case Inst. of Tech., Cleveland, Ohio.
FINAL REPT. ON CONTRACT W28-099-ac-141, EXPERIMENTAL PHASE, by K. S. Kunz, F. E. Brammer, and J. D. Johannesen. Rept. for 1 July 48-30 Sep 49. 38p. ATI-69 376.
Order from LC mi$3.00, ph$6.30 PB 138 966

This report describes the design, construction, and testing of a plaster of Paris model of the Rinehart parallel plate analog of the Luneberg lens.

Columbia U. School of Engineering, New York.
CROSS-COUPLED MULTI-DIMENSIONAL FEEDBACK CONTROL SYSTEMS, by Philip E. Sarachik. Technical rept. T-30/B on Contract AF 18(600)677. 15 May 58, 122p. 24 refs. CU-46-58-AF-677; AFOSR TN-58-556; AD-158 374.
Order fron LC mi$6.30, ph$19.80 PB 137 446

This research is concerned with multi-dimensional systems having the particular structure in which the desired functional relation is specified parametrically in terms of one of the variables, and in which the functional errors are used to control all the variables. The major aspects of the system considered in this work are: Mathematical Description: The differential equations describing the system are derived and represented rather simply in vector matrix notation. Stability: The proper performance requirements of the overall system are identified with the stability properties of a "reduced system." Three stability theorems are then proven, two of which are applicable to two dimensional systems and one to the n-dimensional case. Dynamic Behavior and Synthesis: The linearized equations in the vicinity of equilibrium are derived, and a synthesis procedure is suggested which combines the non-linear methods required to establish stability in the large with linear designs for good dynamic behavior.

Columbia U. School of Engineering, New York.
THE EFFECTS OF QUANTIZATION IN FEEDBACK SYSTEMS, by John E. Bertram. Technical rept. T-28/B on Contract AF 18(600)677. 15 Mar 58, 76p. 25 refs. CU-44-58-AF-677-EE; AFOSR TN-58-323; AD-154 227.
Order from LC mi$4.50, ph$12.30 PB 137 726

The present work utilizes the concept of the state of a dynamic system in order to obtain a mathematical formulation which permits an easy determination of the upper bound on the error in the state variables due to quantizers in an otherwise linear sampled-data feedback system. The same formulation in conjunction with the norm of a vector has been used to obtain sufficient conditions for global stability of several classes of non-linear sampled systems, as well as desirable operating conditions for a random quantizer.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
STANDARD SUBMINIATURE PACKAGED ELECTRONIC VIDEO AMPLIFIER AND HYDROPHONE AUDIO FREQUENCY AMPLIFIER SUBASSEMBLIES, by James P. Welsh. Final development rept. on Contract NObsr-434(31). 1 Sep 53, 107p. 156 refs. Rept.

no. UM-647-D-22.
Order from LC mi$5.70, ph$16.80 PB 139 629

Subminiature Video Amplifier, Trigger Amplifier, Hydrophone Amplifier and Power Supply Subassemblies have been developed for the U.S. Navy, Bureau of Ships, to provide reliable electronic equipments capable of long life operation under extreme environmental conditions. These unitized components exhibit improved electronic performance over a range of "sink connector" temperatures from -40° to over 110°C and are smaller, lighter, and more efficient than their larger counterparts. The subassemblies are hermetically sealed and include plug-in connectors for rapid interchangeability in major units of electronic equipment. Each subassembly type has been carefully designed for large quantity production and it is believed that their procurement costs will be considerably less than those of their larger equivalents.

Diamond Ordnance Fuze Labs., Washington, D. C.
ANALYSIS AND DESIGN OF TRANSISTOR VIDEO AMPLIFIERS, by T. A. Prugh. 15 Dec 57, 15p. 9 refs. TR-509.
Order from LC mi$2.40, ph$3.30 PB 137 380

The analysis of a single stage amplifier is carried out based on the Giacoletto equivalent circuit. Four methods of exchanging amplification and bandwidth are described. High-frequency compensation techniques are also presented. Multistage amplifier design is then considered, including the effect of bandwidth shrinkage due to multiple stages.

Diamond Ordnance Fuze Labs., Washington, D. C.
INTRODUCTION TO TRACK-WHILE-SCAN RADAR, by J. M. Kirshner and C. F. Ravilious. 15 Jan 58, 42p. TR-476.
Order from LC mi$3.30, ph$7.80 PB 137 389

Part I discusses manual tracking, rate-aided manual tracking, automatic tracking, manual and automatic acquisition, the radar equation, thermal noise, scintillation noise, clutter, and the advantages of monopulse as compared to a single beam. Part II discusses in some detail the application of probability theory to the calculation of the angular accuracy obtainable from track-while-scan radar under certain assumed conditions. These same calculations can also be used to determine the probability of keeping the target in track.

Diamond Ordnance Fuze Labs., Washington, D. C.
A RUGGED, WIDE-BAND, MAGNETIC TAPE RECORDER, by J. D. Rosenberg. 1 July 57, 18p. TR-485.
Order from LC mi$2.40, ph$3.30 PB 137 087

A wide-band multi-channel magnetic tape recording system has been designed for unattended use under adverse field conditions. The recorder can be packaged in a hermetically sealed enclosure where provisions are made for bringing in the transducer information and a timed pretest signal. Timing control of all internal operations is assumed by the system itself upon receipt of the timing signal. The equipment is powered by an integral 24 volt, 35 amp. -hr battery. Each complete data channel will yield useful recorded information from 1 cps to over 200 kc/s. A dynamic range of over 30 db is maintained to beyond 100 kc/s. The total record time is 40 seconds. There are four complete data channels and one 10 kc/s marker channel.

Dielectrics Lab., Johns Hopkins U., Baltimore, Md.
MOISTURE RESISTANCE AND DIELECTRIC BREAKDOWN OF ELECTRICAL INSULATING MATERIALS, by John J. Chapman and Louis J. Frisco. Annual interim rept. for 1 Jan-31 Dec 57 on Contract DA 36-039-sc-73156. 14 Jan 58, 35p. 4 refs.
Order from LC mi$3.00, ph$6.30 PB 136 196

The objectives of this investigation are to determine the effects of moisture and heat on the electrical and physical properties of representative plastics and ceramics of various types; to derive expressions of mathematical relations describing various effects on dielectric properties as functions of time, temperature and relative humidity.

General Electric Co., Hudson Falls, N. Y.
INVESTIGATION AND RESEARCH PERTAINING TO THE DEVELOPMENT AND DESIGN OF TANTALUM ELECTROLYTIC CAPACITORS, by D. Mohler. Quarterly rept. no. 8 (Final) for Sep-Nov 56 and one month extension on Contract no. DA-36-039-sc-64558. [1956] 44p.
Order from LC mi$3.30, ph$7.80 PB 139 618

The electron diffraction work on tantalum oxide films is summarized in this report. Good anodic films cannot be distinguished from poor films by means of electron diffraction techniques. Anodic films formed in phosphoric acid have been compared with those made in Glycolonitrile by life test data. The electrical characteristics of Glycolonitrile films are superior in all respects to those formed in phosphoric acid solutions. The Glycolonitrile formed anodic films are more stable and show lower electrical losses. Concentrated HF or NaOH 30% at 100°C appear to be suitable for cleaning tantalum prior to anodizing. Life test data is given for a number of test capacitors made with Dexter paper and LC-141 and rated at 150 VDC, 125°C; 200 VDC, 125°C; 250 VDC, 125°C; 300 VDC, 85°C; and 350 VDC, 85°C. All of these units show excellent electrical characteristics. The 150 VDC, 125°C units and the 300 VDC, 85°C units are indicative of the type of unit which can be made commercially. The data for test capacitors constructed with a one mil thick fiberglass cloth spacer are given. Teflon bushings have been compared with butyl rubber bushings in test capacitors rated at 85°C and 125°C. All of the butyl rubber units failed at 125°C and the failure rate at 85°C was excessively high. An examination of the filler used in the butyl rubber shows that over 1% NaCl is present. The presence of this salt is probably the reason for the failures.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
AGING STUDY OF METAL PLATING ON QUARTZ CRYSTALS, by R. J. Raudebaugh and R. B. Belser.

Quarterly rept. no. 6, 1 Aug-1 Nov 53, on Contract DA 36-039-sc-42453. Dec 53, 73p.
Order from LC mi$4.50, ph$12.30 PB 135 907

Iridium has been successfully sputtered at a rate of 120 angstroms per minute. Rhodium, platinum and iridium have given excellent performance as stable coatings for quartz crystals. A new method of adjusting crystals to frequency by the removal of microportions of plating is outlined.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
AGING STUDY OF METAL PLATING ON QUARTZ CRYSTALS, by Richard B. Belser. Rept. no. 7 (Interim) 1 May 52-1 Apr 54, on Contract DA 36-039-sc-42453. May 54, 230p. 25 refs.
Order from LC mi$10.20, ph$34.80 PB 135 906

Aging characteristics of thin films of 19 metals deposited on glass, quartz or silicon monxide substrates by evaporation, 15 by sputtering and five by electroplating have been studied. Aging changes are normally signified by grain growth, loss of occluded gas and rearrangement of the atoms of the film to a state of lower energy. They are accompanied by a lowering of the electrical resistivity of the film, by an agglomeration or coarsening of the structure of the film as seen in optical or electron micrographs and in a sharpening of the lines of x-ray and electron-diffraction patterns of the metal film. Information as to the alloying characteristics of metal pairs, for which no information exists in the literature, is obtainable by thin-film techniques. As prospective resonator coatings, metals of greatest usefulness appear to be gold, rhodium, platinum, silver, aluminum and nickel.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
STUDY OF THE EFFECTS OF PROCESSING TECHNIQUES AND MATERIALS ON AGING OF QUARTZ CRYSTAL UNITS, by Richard B. Belser. Final rept. 15 May 55 - 1 July 57 on Contract DA 36-039-sc-64613. 413p.
Order from LC mi$11.10, ph$62.10 PB 136 213

The 420 quartz resonators tested were coated with gold, rhodium, aluminum, platinum and bimetal films rhodium plus gold, platinum plus gold, platinum plus rhodium or silver plus nickel. Containers were the HC-6/U can in nickel-silver, copper and glass and the T 5-1/2 glass envelopes. Gold or rhodium coatings gave a higher percentage of good units; disadvantages of high aging temperatures (450°C) were obvious in the case of units plated with rhodium or aluminum. Relatively few units showed drifts greater than 0.000 0.00015 percent in test periods of 6 months. The careful fabrication of these resonators and the materials used allowed operation of several units mounted in glass at temperatures near 500°C.

Johns Hopkins U. [School of Engineering] Baltimore, Md.
PRESENTATION AND ANALYSIS OF SIGNALS. PART I. THE USE OF ORTHOGONALIZED EXPONENTIALS, by W. H. Huggins. Rept. on Contracts AF 19(604)1941 and Nonr-248(53). 30 Sep 57, rev. 15 Nov 58, 73p. 16 refs. AFCRC rept. no. TR-57-357; AD-133 741.
Order from LC mi$4.50, ph$12.30 PB 133 065-R

The best representation for the analysis of information-bearing signals is that which requires the fewest number of parameters. Phenomenological considerations suggest that these parameters should be of two types -- temporal and structural. The first type specifies those instants or epochs in absolute time at which new signal components are created, and the second type specifies the waveshape of the particular signal component associated with each epoch. This report discusses the application of orthogonalized exponential components in representing the elementary signal waveforms associated with each epoch. After formulating a simple analytic representation for a signal generator, the construction of an orthonormal-filter for measuring the signal coordinates relative to an orthonormal basis constructed from any prescribed set of exponentials by Kautz' method, is described. Experimental data are given showing that a small alphabet of damped exponentials are capable of approximating a variety of waveforms with surprisingly good fidelity. It is shown that the orthonormal basis formed from exponentials by Kautz' method also provides a representation for linear systems. This representation may be particularly useful in the study of empirically defined devices and systems. Each system transmittance is represented by a triangular matrix of numbers. The rules for combining these matrices when subsystems are interconnected are the matric equivalents of the usual Laplace-transform expressions. By using the orthonormal filtration techniques described previously, the numerical values of the matrix elements for any linear system may be measured directly.

Lenkurt Electric Co., Inc., San Carlos, Calif.
DEVELOPMENT OF TELEPHONE TERMINAL AN/TCC-24 (XC-1), by Terry R. Holmes, Erwin F. Benesi, and William E. Lucier. Quarterly technical rept. 3, 1 Aug-31 Oct 56 on Contract DA 36-039-sc-64449. [1956] 85p. AD-117 827
Order from LC mi$4.80, ph$13.80 PB 138 953

The purpose of this project is to design, develop, and construct models of a 4-channel carrier telephone terminal which will employ modern techniques for miniaturized circuitry and construction, and which will meet the operational and environmental requirements necessary for military field use. The telephone terminal will have frequency stacking capabilities and provisions for employing various signaling options.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
DETECTION OF RADAR ECHOES ON NOISE. PART I: STATISTICAL PRELIMINARIES AND DETECTOR DESIGN, by I. S. Reed, E. J. Kelly, and W. L. Root. Technical rept. no. 158 on Contract no. AF 19(122)458. 20 June 57, 23p. 9 refs. AD-150 865.
Order from LC mi$2.70, ph$4.80 PB 139 209

The detection of radar echoes in Gaussian noise is discussed. A complex-valued video process is

adopted which carries both the information of the envelope of the RF carrier and its phase, referred to a local oscillator that is coherent with the transmitter. The mathematical framework of the detection of continuous signals in noise is based on the work of U. Grenander (Ark. Mat. 1:195, 1950). The main difference in the two approaches consists in the use of a complex process which has a Hermitian-symmetric covariance function; this makes the observable coordinates complex-valued. The Neyman-Pearson philosophy of hypothesis testing is adopted for the detection of echoes in noise. Examples are given to illustrate this likelihood-ratio test in the radar problem.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
DETECTION OF RADAR ECHOES IN NOISE. PART II: THE ACCURACY OF RADAR MEASUREMENTS, by I. S. Reed, E. J. Kelly, and W. L. Root. Technical rept. no. 159 on Contract AF 19(122)-458. 19 July 57, 26p. 7 refs. AD-150 866.
Order from LC mi$2.70, ph$4.80 PB 139 239

The discussion of radar echoes in Gaussian noise is extended to the problem of radar accuracy, i.e., the estimation of signal parameters for a single target. The maximum accuracy which can be attained from the input information is computed together with the factors that determine this accuracy. The detection criterion and the estimation of signal parameters is discussed and extended to cover coherent detection and estimation when several independent operations are made. Approximations are worked out to the estimates in the strong echo case. The results are applied to the analysis of radar accuracy (1) by making the abstract set of parameters $(a, \ldots, a_K)$ correspond to the actual parameters of interest in radar, and (2) by assuming that the noise has a broad-band white power spectrum. Large signal consistency and approximations, and regularity conditions, continuity, and differentiability are also discussed.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
HIGH-SPEED GRADED-BASE-TRANSISTOR SWITCHING CIRCUITS, by R. H. Baker, E. J. Chatterton, Jr. and A. C. Parker. Technical rept. no. 130 on Contract AF 19(122)458. 10 Dec 57, 29p. 2 refs. AD-110 030.
Order from LC mi$2.70, ph$4.80 PB 139 204

Graded-base transistors (GBT) of the p-n-p type were incorporated into the following switching circuitry designs: (1) constant amplitude oscillator, (2) sine-to-pulse converter, (3) regenerative pulse amplifier, (4) AND gate, (5) AND-OR gate, (6) flip-flop, (7) indicator lights, and (8) large computer (a 6-bit parallel shift register and a binary accumulator) elements. The RCA 2N384 GBT's used in these circuitry designs resemble vacuum-tube characteristics more closely than do the alloy units used in the past. Specifically, while the units have HF response (a_{co} = 50 to 70 mc) due to the built-in field arising from the nonuniform doping of the base region, the saturation time is long, i.e., of the order of that exhibited by 1- to 5-mc (a_{co}) transistors. Initial results with these high-speed circuitries indicate that the GBT's are well suited for deriving high-power gains at high frequencies, in spite of the fact that the transistors are early samples and are not optimized for switching work. An extension of circuit speed capabilities included the completion of an ultrahigh-speed bistable configuration with buffer outputs and antirace circuit.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
ULTRASONIC-DELAY-LINE TERMINATING CIRCUITS AND PASSBAND MEASUREMENTS, by Martin Axalbank. Technical rept. no. 160 on Contract AF 19(122)-458. 12 July 57. 8p. AD-150 867.
Order from LC mi$1.80, ph$1.80 PB 139 238

A single-tuned ultrasonic-delay-line terminating circuit is described which is unaffected by series lead inductance. This delay-line terminating circuit is convenient for multichannel operation of a delay line. The series lead inductances are tuned and loaded to give the desired center frequencies and bandwidths. The terminating circuit is also effective for large-bandwidth single-channel operation. The circuit was adapted to the problem of measuring the intrinsic (acoustic) bandpass curve of a delay line. Nine delay lines from 3 different sources were measured. The bandpass curves were uniformly smooth. The center frequency was usually lower, and the 3-db bandwidth was always larger than that quoted by the manufacturer.

Long Island U.
HUMAN FACTORS IN MAINTENANCE, PART 2. MAINTENANCE PROBLEMS ANTICIPATED AS A RESULT OF SUBMINIATURIZATION, by Richard P. Runyon. Rept. on Contract Nonr-1912. 30 Apr 58, 61p. Technical rept. NAVTRADEVCEN 20-OS-23-2.
Order from LC mi$3.90, ph$10.80 PB 138 563

This report explores the potential impact of recent developments in electronic techniques on the task of maintaining future electronic equipment. The results are summarized in the Brief of Study.

Material Lab., New York Naval Shipyard, Brooklyn.
DEVELOPMENT OF EXPERIMENTAL TELEPHONE CABLE UTILIZING VINYL INSULATION OVER GLASS WRAPPING, by A. M. Deleeuw. Final rept. 16 July 57, 5p. Lab. project 5248-101.
Order from LC mi$1.80, ph$1.80 PB 138 008

The project was conducted to determine whether telephone cables insulated with polyvinyl chloride insulation over glass wrapping would meet the gas flame requirements for Class E insulation.

Mellon Inst. of Industrial Research, U. of Pittsburgh, Pa.
HIGH TEMPERATURE PRINTED CIRCUITRY, by G. H. Young, C. H. T. Wilkins and others. Quarterly rept. no. 8, 3rd series, 1 July-30 Sep 58, on Computer Components Fellowship no. 347, Contract AF 19(604)1959. 9 Jan 59, 52p. AFCRC TN-58-588; AD-207 521.
Order from LC mi$3.60, ph$9.30 PB 138 813

Research investigations relevant to printed circuit development of miniature components capable of continuous operation at temperatures up to 750°C have been continued. Investigations involving the preparation of miniature capacitors by vacuum evaporation techniques have illustrated the need for multiple dielectric layers in minimizing porosity effects. Diffusion of the electrode metal into the dielectric at elevated temperatures has been overcome by the interposition of a barrier layer of MgF_2. Gold-palladium alloy film resistors exhibiting negative and positive temperature coefficients of resistance have been prepared.

Melpar, Inc., Falls Church, Va.
SONAR SYSTEM CRITERIA STUDY, by S. M. Sussman, D. Van Meter, and W. B. Floyd. Final rept. for 1 June 56-31 Aug 57 on Contract Nonr-2154(00). Aug 57, 123p. 32 refs.
Order from LC mi$6.30, ph$19.80 PB 135 733

The purpose of this study is to explore the applicability of decision theory, game theory, information theory and other relevant disciplines to the derivation of sonar system criteria. The basic assumptions of the theories are examined to determine suitable applications of them among the various aspects of detection and extraction system evaluation.

Microwave Lab., Stanford U., Calif.
BASIC MICROWAVE RESEARCH, by M. Chodorow. Scientific rept. no. 6 on Contract AF 19(604)1930. May 58, 14p. 1 ref. M. L. rept. no. 507; AFCRC TN-58-165; AD-152 402.
Order from LC mi$2.40, ph$3.30 PB 137 681

Five projects are presently supported by this contract. In the large-signal klystron theory project, an expression for the radial distribution of the fundamental component of rf current as a function of the distance down the klystron drift tube has been evaluated numerically on a computer. In the connected-ring structure project, the experimental work has been completed, and a report of the results of the work is in preparation. In the coupled-cavity-theory work, an attempt was made to obtain a more detailed verification of the equivalent circuits used. In the electron gun studies project, the design of an electron gun based on one of the curvilinear space-charge-flow solutions described in Scientific Report No. 4 has been carried out.

Naval Air Test Center, Patuxent River, Md.
IMPEDANCE CHARACTERISTICS OF FIXED-LENGTH ANTENNAS. Rept. no. 1 (Final) on Proj. TED no. PTR EL 41071. 20 May 55, 34p. Serial ET315-182.
Order from LC mi$3.00, ph$6.30 PB 137 920

Operating activities have consistently reported difficulty in maintaining long-range communications with available equipment and frequency allocations. A project was undertaken for the purpose of improving communications coverage through better understanding of the antenna systems involved and by refinement of equipment tuning procedures. Impedances of long-wire antennas, ranging in length from 20 to 102 feet were measured over the frequency range from 2 to 24 mc. Impedance charts were constructed as aids in selection of operating frequencies on the basis of power transfer by the antenna. Loading characteristics of the AN/ART-13 and AN/ARC-2 equipments were investigated. Recommendations are made concerning antenna length selection and equipment tuning techniques for improved hf operation.

Naval Ordnance Lab., Corona, Calif.
A METHOD FOR GENERATING RADAR NOISE FOR MISSILE SYSTEM SIMULATION STUDIES, by A. C. Sevy. 20 Aug 58, 30p. NOLC rept. 423; NAVORD rept. 5927.
Order from LC mi$2.70, ph$4.80 PB 136 580

Certain power-density spectra computed from actual radar tracking jitter were assumed to be representative in describing particular radar performance. High-gain dc amplifiers were used to synthesize active linear filters with the same amplitude frequency response characteristics as those implied by the power-density spectra. Simulated noise with the same spectral content as the actual radar noise was generated by feeding noise with a flat power-density spectrum into these filters.

Naval Ordnance Lab., Corona, Calif.
A SURVEY OF THE POTENTIAL OF SULFUR DIOXIDE RESERVE BATTERY ACTIVATION, by J. Konecny. 16 Jan 58, 15p. 24 refs. NOLC rept. 394; NAVORD rept. 4639.
Order from LC mi$2.40, ph$3.30 PB 136 729

This report, which consists of a review of the chemistry of liquid sulfur dioxide solutions, has the purpose of estimating the potential battery applications of such solutions. The main purpose of this report is to supplement the available texts with additional references which are pertinent to battery applications. In view of the interest in non-aqueous types of power supplies, the author hopes that this report may be useful to investigators contemplating work in this field.

Naval Ordnance Laboratory, White Oak, Md.
NUCLEAR IRRADIATION EFFECTS ON FERROMAGNETIC CORE MATERIALS, by R. S. Sery and D. I. Gordon. June 58, 72p. 24 refs. NAVORD rept. 6127; Supersedes NAVORD rept. 4381, PB 131 014.
Order from OTS $2.00 PB 151 174

Effects of nuclear irradiation on the magnetic properties of 14 representative core materials have been investigated. Measurements before, during and after irradiation were made at the Brookhaven National Laboratory Reactor at a flux level of about 10^{12} neutrons/cm^2sec. and for a total integrated neutron flux of $\sim 10^{18}$ nvt. The fast flux (E > 1 ev) was about 10^{11} n/cm^2sec. and the gamma flux $\sim 10^{11}$ photons/cm^2sec. (E was 1 to 2 Mev). The temperature of the cores was 70° to 80°C with 10-20% of the total temperature attributed to gamma heating. The high nickel-iron alloys which have the highest permeabili-

ties and lowest coercive forces, showed the greatest changes in magnetic properties. Grain oriented and unoriented 3 to 3.5 silicon-irons and a 3-1 silicon-aluminum-iron (having square loop characteristics) showed small changes in their magnetic properties. The magnetic properties of a thermally ordered 16-aluminum-iron improved somewhat, while those of a thermally disordered material showed negligible changes.

Naval Ordnance Test Station, China Lake, Calif.
NOTS TEST DEPARTMENT STANDARD PRACTICE FOR RANGE INSTRUMENT CONTROL CIRCUITS, by B. W. Pike Oct 56, 24p. 7 refs. NOTS 1615, supersedes Technical memo. 251, AD-141 828.
Order from LC mi$2.70, ph$4.80 PB 137 698

The NOTS Test Department standard practice for range instrument circuits, insures interchangeability of instruments among the several ranges. The standard practice establishes control-circuit voltage limits of 52 to 48 v d.c. for sending and 52 to 36 v for receiving. It establishes a standard relay of 5,000 ohms resistance and 5 milliamp operating current. It also establishes circuit protection requirements and a limit of 7 v d.c. as a circuit testing voltage.

Naval Research Lab., Washington, D. C.
THE CLASSIFICATION AND COUNTING OF DROP-OUTS FROM MAGNETIC TAPE RECORDING SYSTEMS, by Robert H. Carson. Interim rept. 10 Feb 59, 33p. NRL rept. no. 5253.
Order from OTS $1.00 PB 151 286

An investigation has been initiated, first, to determine the number and size of drop-outs obtained from magnetic tape recording systems and the extent that various factors affect the number and size of drop-outs and, second, to develop a reliable method of testing the drop-out characteristics of magnetic tape recording systems so that accurate evaluations of tape itself can be made and correlated to a specific end use. The instrumentation for classifying and counting drop-outs according to size is discussed in detail. Commercially available plug-in units are used throughout. A drop-out simulator used for calibration purposes is described along with the calibration technique used to evaluate the reliability of the overall system. Photograpns of the signal amplitude envelopes of many types of drop-outs are included to show the various types of drop-outs that occur. Preliminary data on the number and size of drop-outs from present day tapes (and a standard machine) are given. There are curves showing the number of drop-outs per 1000 ft of tape for any amplitude reduction for one sample of tape from each manufacturer, and data on the lengths of drop-outs are plotted. One observation is that in general the drop-out distribution according to length is very similar for all standard instrumentation tapes. Another observation is that about 95 percent of all drop-outs greater than 3 db, on all tapes, except the new sandwich type, are shorter than 35 mils in length, regardless of the total number of drop-outs of all lengths.

Naval Research Lab., Washington, D. C.
COMPARISON OF ZERO-ORDER AND FOURTH-ORDER AIDED COMPENSATORY SYSTEMS AS A FUNCTION OF COURSE FREQUENCY, by R. Chernikoff, J. H. Bowen, and H. P. Birmingham. Interim rept. 26 Jan 59, 8p. 3 refs. NRL rept. 5262.
Order from LC mi$1.80, ph$1.80 PB 136 788

This study compared closed-loop man-machine control system performance between a zero-order system (no integrators in the loop) and an aided fourth-order system (four integrators in the loop), using complex course inputs over a wide range of frequencies. It was found that for lower frequency inputs the fourth-order system is greatly superior, but that as frequency increases, this superiority diminishes. Finally,, as frequency is increased still further, the better performance is obtained with a zero-order system. These results are in agreement with deductions from servomechanism and human engineering theory.

Naval Research Lab., Washington, D. C.
EFFECTS OF AMBIENT ILLUMINATION, CRT BIAS, AND NOISE UPON TARGET DETECTIBILITY WITH A B-DISPLAY, by R. E. Gardner and J. M. Carl. Interim rept. 28 Jan 59, 9p. 5 refs. NRL rept. 5264.
Order from LC mi$1.80, ph$1.80 PB 136 813

An investigation has been carried out on the effects of ambient illumination, receiver gain, and cathode-ray-tube grid bias on target detectibility for a typical airborne-intercept radar B-display. Aircraft environmental conditions were simulated for ambient illumination ranging from dark to direct sunlight. It was found that there are optimum values of receiver gain and crt bias for most favorable target detectibility and that these values hold for all possible levels of ambient illumination.

Naval Research Lab., Washington, D. C.
FAST SCAN: A 36-POSITION MULTIPLE-CHANNEL ELECTRONIC SWITCH, by Fred R. Fluhr. Final rept. 3 Mar 59, 31p. 5 refs. NRL rept. 5254; AD-212 986.
Order from LC mi$3.00, ph$6.30 PB 136 512

A 36-position electronic switch with six analog channels and seven control channels in parallel, called the Fast Scan, was developed for the Naval Data Handling System (NDHS) at the U.S. Naval Research Laboratory's Chesapeake Bay Annex. The Fast Scan sequentially scans the NDHS stores at the radar pulse-repetition frequency and makes available target-position, velocity, height, and category data in parallel for each of 24 stores at the various PPI repeaters. The target plan-position and velocity-vector information is displayed during the radar recovery time and thus appears to be displayed simultaneously with the raw radar video. Each input position of each analog channel has an input impedance of one megohm when activated. The overall error from the activated input position to the output is less than ±50 millivolts over a range of ±30 volts. The Fast Scan can be driven with pulse-repetition frequencies up to 4000 pulses per second. The control channels provide the timing pulses so that the proper outputs of the Fast Scan are displayed at the various positions in the NDHS. The six analog channels re-

quire 12 vacuum-tube envelopes and 432 silicon-junction diodes. The seven control channels require ten vacuum-tube envelopes and 172 silicon diodes. The commutator which sequences the Fast Scan requires four Magnetron Beam Switching tubes, three tube envelopes, and 37 diodes.

Naval Research Lab., Washington, D. C.
SOME DESIGN CONSIDERATIONS CONCERNING LINEAR ARRAYS HAVING DOLPH-TCHEBYCHEFF AMPLITUDE DISTRIBUTIONS, by Max L. Reuss, Jr. Interim Rept. 12 Feb 59, 28p. 2 refs. NRL rept. 5240.
Order from OTS $0.75 PB 151 231

Two particular problems encountered in the design of traveling-wave arrays for scanning have been studied for arrays having Dolph-Tchebycheff amplitude distributions. The first problem concerns the effect that deforming the amplitude distribution has on the radiation patterns. Radiation patterns have been calculated as a function of the number of elements, side-lobe level, and amount of distortion. The second problem concerns the calculation of gains of infinitesimal dipole arrays. The parameters studied are the side-lobe level, number of elements, and interelement spacing.

Naval Research Lab., Washington, D. C.
VOLUMETRIC SCANNING GCA ANTENNA PROTOTYPE, by W. F. Gabriel. Oct 58, 75p. 9 refs. NRL rept. 5195.
Order from LC mi$4.50, ph$12.30 PB 134 549

A prototype model of the Volumetric Scanning GCA Antenna has been constructed and tested. The new antenna will permit coordinated coltrol of multiple landings of high-speed aircraft by virtue of its narrow-pencil-beam resolution and solid, three-dimensional, rapid-scan coverage.

New Mexico U., Albuquerque.
LINEAR SWEEP CIRCUIT, by John R. Green and Paul O. Scheie. Rept. on Contract AF 49(638)34. July 57, 13p. AFOSR TN-57-434; AD-136 424.
Order from LC mi$2.40, ph$3.30 PB 135 088

A simple electronic circuit employing feedback is described that will produce a positive pulse whose amplitude is proportional to the duration of a positive input pulse. The circuit is analyzed using fundamental principles. The theory of propagation of errors is used in comparing the observed and the predicted behavior of the circuit.

Office of the Director of Defense Research and Engineering, Washington, D. C.
ENVIRONMENTAL REQUIREMENTS GUIDE FOR ELECTRONIC COMPONENT PARTS. Mar 59 [13]p. ECP-2, supersedes PB 131 423.
Order from OTS $0.50 PB 131 423R

This document establishes the research and development objective environmental design requirements for use in current and future electronics planning, in research and development of electronic component parts, as well as appropriate test procedures.

Pittsburg Consolidation Coal Co., Library, Pa.
CONVERSION OF CARBONACEOUS FUELS TO ELECTRICAL ENERGY, by Everett Gorin and Howard L. Recht. Final rept.1 May 54 to 30 April 57, on Contract DA-36-039-sc-63090. 47p.
Order from LC mi$3.30, ph$7.80 PB 136 014

This report summarizes the results of the three years work on the project. Detailed results obtained during the twelfth quarter are also presented, since they have not been reported elsewhere. A procedure has been worked out for the preparation of magnesia electrolyte plates of adequate strength and porosity for use in the fuel cell. The cell has been operated for several relatively long periods of time up to nine days in duration. The problem of cracking of the electrolyte plates in cell operation has been solved. A stable power output has been achieved over a long operating period on continuous current drain at a relatively low current density, i.e., 11.3 ma/cm^2. The cell did not, however, give a stable power output at high current densities, i.e., at 28.3 ma/cm^2 or higher. The general level of cell performance was not as high as in some runs reported previously. A slow deterioration of cell performance occurred with time. The deterioration is thought to be due to a slow corrosion process particularly at the air electrode.

Radiation Lab., Mass. Inst. of Tech., Cambridge.
THERMOPILE FOR USE WITH R-F WATER LOADS, by Rita B. Hughes. [Rept. on Contract OEMsr-262]. [26 Oct 45] Internal Group Rept. no. 55.1-10/26/45.
Order from LC mi$1.80, ph$1.80 PB 139 630

Rome Air Development Center, Griffis AFB, N. Y.
BRITISH AND AMERICAN ELECTRONICS MAINTENANCE TECHNIQUES FROM THE MAINTAINABILITY AND EQUIPMENT DESIGN VIEWPOINT, by Milton V. Ratynski. Oct 57, 77p. 20 refs. RADC TR-57-147; AD 131 247.
Order from LC mi$4.50, ph$12.30 PB 136 709

This report is an introduction to the problem of designing highly "maintainable" electronic equipment for the military services. As a result of a recent visit, by the author, to Great Britain and subsequent research on the subject, both the British and the American general maintenance philosophies are presented. Present-day maintenance methods are described for all the military services of Great Britain and the United States. A discussion is held on equipment design recommendations to improve "maintainability" of services equipment; some British and American viewpoints are presented. Design techniques are suggested for today's and tomorrow's electronic systems and equipments which would greatly improve the "maintainability", training and logistics problems associated with increasingly more complex military weapons and warfare problems.

Rome Air Development Center, Griffiss AFB, N. Y.
A COMPARISON OF TWO CATHODE-RAY TUBES FOR SIGNAL DETECTABILITY AS A FUNCTION OF RANDOM NOISE LEVEL, by Robert L. Erdmann and John W. Gunvordahl. Sep 58, 19p. 6 refs.
RADC TR-58-118; AD 148 902.
Order from LC mi$2.40, ph$3.30 PB 136 572

This report discusses a study which was a comparison of a 12DP7 and a 12DP19 Cathode-ray tube for signal detectability under various levels of grid bias voltage and random noise voltage. The curves relating signal detection to the above parameters were in general agreement with previous research. Under all viewing conditions of this experiment the 12DP19 was superior to the 12DP7, and when the minimum signal-to-noise ratios were compared, the 12DP19 showed a 22 percent gain in range over the 12DP7. In addition, the report discusses the manner in which noise affects signal detectability.

Rome Air Development Center, Griffiss AFB, N.Y.
DESIGN AND DEVELOPMENT OF RUGGEDIZED COAXIAL ATTENUATORS, by Vincent Kapfer.
July 58, 35p. 2 refs. RADC TR-58-86; AD-148 778.
Order from LC mi$3.00, ph$6.30 PB 137 553

This report describes the design and development of a set of four ruggedized attenuators rated at 3, 6, 10, and 20 decibels, and designated as CN-333 (XW-1)/U, CN-334 (XW-1)/U, CN-336 (XW-1)/U, and CN-335 (XW-1)/U respectively. The attenuators fit directly into a 7/8-inch coaxial line and may be used with military summation bridges AN/URM-22 and AN/URM-23 for field measurements of radar system power. The frequency range covered is from dc to 4.0 kmc, and power up to 10 kw peak and 5 watts average can be handled by using the appropriate attenuator. The voltage standing wave ratio is 1.30 or less throughout the operating range.

Rome Air Development Center, Griffiss AFB, N. Y.
DEVELOPMENT OF LIGHTWEIGHT MAGNESIUM WAVEGUIDE, by Anthony F. Gurdo and John E. McCormick. June 58, 28p. 5 refs. RADC TN-58-153; AD-148 761.
Order from LC mi$2.70, ph$4.80 PB 137 674

Determination of electrical and mechanical properties, method of fabrication, and a method to prevent corrosion of the pressurized magnesium waveguide. Thinner wall tubing can be produced, closer wall thickness tolerances can be obtained, and inner surfaces made smooth.

Rome Air Development Center, Griffiss AFB, N. Y.
EVALUATION OF PRECIPITATION EFFECTS ON RADARS OPERATING AT MILLIMETER WAVELENGTHS, by Vincent J. Coyne. Sep 58, 28p. 13 refs.
RADC TN-58-249; AD 148 906.
Order from LC mi$2.70, ph$4.80 PB 137 447

Automatic landing and taxi control radars are required to operate under adverse weather conditions. Resolution requirements force these radars to operate at wavelengths in the millimeter region where attenuation and backscattering effects are serious. It is important that these radars be evaluated under adverse conditions, to determine if they meet the system requirements. The purpose of this report is to present the background required to perform such an evaluation.

Rome Air Development Center, Griffiss AFB, N. Y.
EXPLOITATION OF PHYSICAL PHENOMENA FOR COMMUNICATIONS, by Joseph L. Ryerson.
Oct 58, 19p. 24 refs. RADC TN-58-277; AD-148 939.
Order from LC mi$2.40, ph$3.30 PB 138 493

The extensive development of radio communication has overcrowded existing facilities. This paper proposes a solution to relieve this condition through the use of phenomena other than present day radio for communications. The paper investigates communication through natural ducts by the use of low frequency radio, sound, light, heat and gamma rays. Areas in which experimental work is required are summarized. Estimates are made of the probable speed rates with which information may be transmitted by use of the cited phenomena.

Rome Air Development Center, Griffiss AFB, N. Y.
THE GENERATION OF SINGLE SIDEBAND CARRIER TELEPHONE CHANNELS BY POLYPHASE MODULATION, by Joseph Mensch. June 58, 17p. 3 refs.
RADC TN-58-161; AD 148 773.
Order from LC mi$2.40, ph$3.30 PB 137 673

Polyphase modulation is shown to be a technique suitable for producing single sideband telephone channels. This technique is capable of providing superior channel bandpass and envelope distortion characteristics. In this report the main limitations of polyphase modulation are analyzed, and the characteristics obtained from an experimental channel are discussed.

Rome Air Development Center, Griffiss AFB, N. Y.
"GHOSTS", A STUDY OF THE FALSE INTERSECTIONS ARISING FROM TRIANGULATION OF UNMATCHED SIGNALS, by Patricia M. Langendorf.
July 58, 29p. 1 ref. RADC TN-58-169; AD 148 786.
Order from LC mi$2.70, ph$4.80 PB 137 672

Triangulation of azimuth bearings to locate moving transmitters results in false intersections, or "ghosts". Behavior of these "ghosts" is discussed and amelioration measures are suggested.

Rome Air Development Center, Griffiss AFB, N. Y.
MODIFICATION OF RADAR TRAINING SET AN/APQ-T2, by Carlton D. Lincourt. Sep 58, 27p.
RADC TN-58-242; AD-148 897.
Order from LC mi$2.70, ph$4.80 PB 137 187

Radar Training Set AN/APQ-T2 has built-in jamming capabilities but they proved inadequate for multiple jammer operation. Therefore it was necessary, for the purpose of simulating a full-scale field test, to make certain modifications to increase the trainer's facilities.

Rome Air Development Center, Griffiss AFB, N. Y.
SHELTER DEVELOPMENTS: A COMPILATION OF SHELTER DATA FOR ELECTRONIC SYSTEMS, by Alex J. Reynolds. July 58, 62p. RADC TN-58-197; AD 148 825.
Order from LC mi$3.90, ph$10.80 PB 137 347

This report presents a compilation of data which represents past and present electronic systems shelter developments by the Rome Air Development Center, New York. General shelter requirements to meet today's military needs are defined. Of the many shelters illustrated, some are obsolete, substandard, or standard, and some are presently in a development status. The sequence of the photographs expresses the design advancements throughout the years.

Rome Air Development Center, Griffiss AFB, N. Y.
SHOCK RESPONSE OF A TWO DEGREES OF FREEDOM SYSTEM, by Stanley M. Ostergren. Oct 58, 39p. 3 refs. RADC TN 58-251; AD 202 096.
Order from LC mi$3.00, ph$6.30 PB 137 898

Failure of electronic equipment due to shock loading is an important factor affecting its reliability. In the design of electronic equipment to withstand shock loading, or when selecting proper shock mounts to protect existing equipment, calculations are so complicated, in actual practice, that they are seldom performed rigorously even in the simplest cases. As a result, most designers make assumptions that simplify the calculations. In this report, an attempt is made to determine conditions under which various assumptions can be made and the amount of error that can be anticipated. This was done by making a rigorous study, with the aid of an analog computer, of a typical system.

Rome Air Development Center, Griffiss AFB, N. Y.
TARGET GENERATOR FOR ALIGNMENT OF VHF AND UHF DIRECTION FINDING EQUIPMENT (SIGNAL GENERATOR SG-136/U), by Anthony D. Rugari. May 58, 21p. RADC TR-58-63; AD-148 715.
Order from LC mi$2.70, ph$4.80 PB 135 312

Signal Generator SG-136/U, a portable battery operated transmitter used for alignment of Azimuth Indicator Units of Direction Finding Equipments operating in the UHF and VHF bands, is described. Theory of operation, specification requirements, test procedures and results of First Article tests of the Signal Generator are included.

Stanford Electronics Labs., Stanford U., Calif.
BAYES ESTIMATION OF RADAR SIGNAL PARAMETERS, by J. E. Keigler. Technical rept. no. 35 on Contract Nonr-225(24). 21 Apr 58, 71p. 26 refs.
Order from LC mi$4.50, ph $12.30 PB 139 071

The concepts of statistical decision theory are applied to the problem of evaluating the parameters of a returned radar signal immersed in noise, these parameters being related to the properties of the target. It is shown that the Bayes estimation procedure is the logical procedure to use in a practical radar system and that the bounded absolute error loss function is more appropriate to many radar situations than the customary squared error. On these premises receivers are designed for several types of targets.

Stanford Electronics Labs., Stanford U., Calif.
CHARACTERISTICS OF RUBY FOR MASER APPLICATIONS, by W. S. Chang and A. E. Siegman. Rept. on Contract AF 33(600)27784. 30 Sep 58, 43p. 5 refs. Technical rept. no. 156-2.
Order from LC $3.30, ph$7.80 PB 136 586

This report presents the numerical analysis of the characteristics of Al_2O_3 - Cr_2O_3 crystal under Zeeman transitions based upon the known spin Hamiltonian. To facilitate the design of masers, the energy levels, the eigen-states, and the matrix elements of the magnetic moment of the Cr^{+++} in this crystal are listed.

Stanford Electronics Labs., Stanford U., Calif.
ELECTRON TRAJECTORIES IN THE BACKWARD-WAVE OSCILLATOR, by J. W. Gewartowski. Rept. on Contract Nonr-225(24). 29 Oct 57, 59p. 15 refs. Technical rept. no. [403]-25.
Order from LC mi$3.60, ph$9.30 PB 137 709

Stanford Electronics Labs., Stanford U., Calif.
INVESTIGATION OF THE TRANSVERSE-FIELD KLYSTRON, by B. Fank. Rept. on Contract DA 36-039-sc-73178. 10 May 58, 84p. 6 refs. Technical rept. no. 305-1.
Order from LC mi$4.80, ph$13.80 PB 138 514

The need for improved low-noise beam amplifiers makes desirable the investigation of new types of beam devices. The work reported here concerns the noise characteristics of a transverse-field klystron. A theory of operation is developed which includes expressions for tube transconductance, beam loading, and noise figure. Three low-frequency experimental klystrons were built to test the theory.

Stanford Electronics Labs., Stanford U., Calif.
STATISTICAL STUDY OF TRANSISTOR HIGH-FREQUENCY EQUIVALENT CIRCUITS, by R. L. Walker. Technical rept. no. 23 on Contract Nonr-225(24). 20 Sep 57, 90p. 10 refs.
Order from LC mi$4.80, ph$13.80 PB 136 433

The conclusion is reached that a simple equivalent circuit can serve as a valuable link between transistor device parameters and the quadripole parameters often sought by circuit designers. It has been demonstrated that it is feasible to characterize a group of transistors by means of a set of mean device parameter values, although the study has also shown that the variability of the device parameters and the quadripole parameters is such that to include 95 percent of all transistors in a group the range of parameters is usually three to one.

Stanford Electronics Labs., Stanford U., Calif.
THERMAL-VELOCITY EFFECTS IN TWO-DIMENSIONAL ELECTRON BEAMS, by C. B. Crumly. Rept. on Contract DA 36-039-sc-73178. 25 Feb 58, 53p. 11 refs. Technical rept. no. 457-2.
Order from LC mi$3.60, ph$9.30 PB 138 515

The design of convergent Pierce-type electron guns has been well systematized, for the solid pencil-beam case, by Pierce and other workers. Because of the growing importance of two-dimensional sheet or strip beams and hollow beams in microwave devices, a need has arisen for design data applicable to these cases. The purpose of this report is to present data on space-charge-limited flow, applicable to the design of convergent Pierce guns for strip beams.

Stanford Electronics Labs., Stanford U. Calif.
TRANSISTOR MEASUREMENTS USING THE INDEFINITE ADMITTANCE MATRIX, by J. P. Paddock. Technical rept. no. 20 on Contract Nonr-225(24). 20 Aug 57, 31p. 9 refs.
Order from LC mi$3.00, ph$6.30 PB 136 434

A method is shown whereby four measurements made directly on commercial bridges may be used to find the admittance parameters of a transistor in any orientation; common-base, common-emitter, or common-collector; merely by taking appropriate sums of the measured quantities.

Stanford Research Inst., Calif.
METHODS AND EQUIPMENT FOR HIGH LEVEL SINGLE SIDEBAND GENERATION IN THE FREQUENCY RANGE OF 1.5 TO 30 MEGACYCLES, Final rept. and instruction manual for Dec 48-Mar 50 on Contract W36-039-sc-38199. 1 Mar 50, 134p. SRI Project no. 134; ATI-171 526.
Order from LC mi$6.90. ph$21.30 PB 139 285

This manuscript is the fourth and final report covering an engineering research study of high-level single sideband generation and the construction of two experimental models of a radio transmitter providing single sideband operation over the frequency range of 1.5 to 30 megacycles and having a peak power capability of 500 watts. The report consists, in the main, of an instruction manual. The operation of the high-level transmitter is described, and a detailed description of its component parts, including all circuit diagrams, is given. Instructions are outlined for installation and for initial and frequency-change tune-up. The results of various tests, together with test techniques, are presented.

Sterling Precision Corp., New York, N. Y.
ANTENNA, HIGH GAIN UHF COMMAND CONTROL, by R. D. Bogner. Final engineering rept. on Contract AF 08(606)1225. 19 July 57, 108p. Rept. no. 300-3; AFMTC TR-57-26; AD-124 148.
Order from LC mi$6.00, ph$16.80 PB 136 132

Surface Combustion Corp., Columbus, Ohio.
TECHNIQUES FOR MINIATURE BATTERY PACK HEATERS, by John K. Siddle. Final engineering rept. on Contract AF 30(602)1240. Mar 57, 69p. Rept. no. 422; RADC TR-57-67; AD-114 397
Order from LC mi$3.90, ph$10.80 PB 135 167

A study of techniques for heating of battery packs at low ambient temperatures during long unattended periods resulted in the selection of a propane fuel system from an original list of twenty seven techniques. The reasons for the elimination of the other techniques and the various fuel controls, insulation methods and construction materials used in the development of the propane fuel system are summarized.

Sylvania Electric Products, Inc., Woburn, Mass.
INDUSTRIAL PREPAREDNESS STUDY: TRANSISTOR MANUFACTURING, by C. Huang. Quarterly rept. no. 2, Phase 2, 1 July 57-30 Sep 57, Contract DA 36-039-sc-72719. 1956, 57p.
Order from LC mi$3.60, ph$9.30 PB 137 161

The purpose of this contract is to establish production design of Devices 1, 2 and 5, to manufacture and to submit samples of these devices for approval and standardization, to establish manufacturing techniques and determine machine operations for pilot production of the approved standardized devices, and finally to produce limited production of approved types of devices to prove out and perfect designs and techniques and to obtain final approval of the devices.

Syracuse U. Research Inst., N. Y.
STUDY OF NEAR-ZONE FIELDS OF LARGE APERTURE ANTENNAS, by Ming-Kuei Hu. Final rept. part 2 on Contract AF 30(602)928. Apr 57, 117p. 8 refs. SURI rept. no. EE282-574F2; RADC TR-57-126B; AD-131 190.
Order from LC mi$6.00, ph$18.30 PB 137 206

In this report, a generalized reciprocity theorem is first proved. It forms the basis to the solutions for both objectives in the present project. Plausible definitions and restictions are given for the far-zone, Fresnel and near-zone regions. Fresnel region field distributions of uniform and non-uniform aperture illuminations for both circular and rectangular apertures are analyzed. Field distribution curves and numerical tables for the new function used are given for the circular case.

Tracerlab, Inc., Boston, Mass.
INVESTIGATIONS ON UTILIZATION OF RADIOACTIVE ENERGY AS A SOURCE OF BATTERY POWER, by Alexander Thomas and Imogene DiBello. Rept. no. 12 (Final) 1 Aug 54-31 Oct 55 on Contract no. DA 36-039-sc-64519. 65p. 10 refs. AD-79 731.
Order from LC mi$3.90, ph$10.80 PB 139 279

Modifications in construction and techniques are described for reducing the temperature coefficient of voltage. Tritium was considered the most promising isotope for use in the gaseous ionization contact potential difference (CPD) type of nuclear battery. Changing from spot welded to evaporated low-work-function electrodes greatly improved the flatness and uniformity of the electrode couples without sacrificing the high CPD when used with PbO_2 anodized on

the other side. The change from plastic to inorganic insulation increased the useful temperature range, probably decreased the ingassing, and reduced the temperature coefficient or voltage. Mica spacers were as good as polystyrene electrically, but hand splitting of the mica was more time consuming and made greater variation in cell spacing. After radiation conditioning, Alsimag 243 glazed with Pb borosilicate was an excellent sleeve and terminal insulator surface with respect to low electrical conductivity and high-temperature stability. A coating of silicone over the outer-glazed ceramic surface prevents electrical leakage due to fingerprints. The coating is not affected by extreme temperatures. A month or more of radiation conditioning is necessary for mica-Alsimag-Mg-PbO_2 battery models to reach maximum voltage and to diminish the sluggishness in current response under load. The best temperature coefficient of voltage above room temperature for model 23C was 0.06% per degree Centigrade; that for model 21B below room temperature was 0.28%. In cold tests under load, all of the models were characterized by a slow drop in current to a somewhat lower equilibrium value than at room temperature and by a slower recovery of voltage. (See also AD-69 290)

Transistor Applications, Inc., Boston, Mass.
INVESTIGATION OF THE APPLICATIONS OF NEGATIVE RESISTANCE DIODES FOR SWITCHING CIRCUITS. Scientific rept. no. 1 on Contract AF 19(604)3066. June 58, 58p. 7 refs. AFCRC TN-58-390; AD-160 844.
Order from LC mi$3.60, ph$9.30 PB 137 830

This report is concerned with the study of negative resistance devices. A comparison is made of the few negative resistance diodes that are available at present. An attempt is made to search deeply into the various characteristics and to simulate negative resistance devices using transistor combinations.

Transistor Applications, Inc., Boston, Mass.
INVESTIGATION OF THE APPLICATIONS OF NEGATIVE RESISTANCE DIODES FOR SWITCHING CIRCUITS. Scientific rept. no. 2, 17 July-17 Sep 58, on Contract AF 19(604)3066. Dec 58, 38p. AFCRC-TN-59-117; AD-209 522.
Order from LC mi$3.00, ph$6.30 PB 139 220

This report is concerned with the study and investigation of Negative Resistance devices and the following subjects have been covered. Measurements of switching time as a function of load resistance and of carrier storage time are presented. Some of the capabilities of negative resistance multivibrators are investigated. Modification of a negative resistance diode characteristic with a transistor is discussed. Determination of the V_E - I_E and V_C - I_E characteristic of a transistor having a negative resistance in the base circuit is explained. Measurements of actual V-I characteristics are presented. A 4-Layer Diode Flip-Flop, having a great deal of tolerance to diode parameter and supply voltage variation, is described.

Washington U., Coll. of Engineering, Seattle.
RADIATION PATTERN SYNTHESIS WITH SOURCES LOCATED ON A CONICAL SURFACE, by Akira Ishimaru and Gedalia Held. Technical rept. no. 26 on Contract AF 19(604)1381. Apr 58, 148p. 26 refs. AFCRC TN-58-177; AD-152 420.
Order from LC mi$7.20, ph$22.80 PB 136 032

This report presents various approaches of synthesizing sources, placed on a conical surface, to produce a prescribed radiation pattern. The sources considered are a series of electric dipoles placed on the surface of the cone around a set of cross-sectional circumference. These circumferences are considered to be equidistant from each other and the dipoles oriented in the direction of the circumference with no circumferential variation in intensity and phase. The radiation field is then expressed by a series of non-orthogonal functions involving products of Bessel and exponential functions. The intensity and the phase of the source would then be specified by the coefficient of this series.

Westinghouse Electric Corp., Baltimore, Md.
EXPERIMENTAL HIGH POWER UHF LINK. Progress rept. no. 17 for Mar 57 on Contract AF 30(602)1256. Apr 57, 9p. RADC TN-57-206; AD-131 103.
Order from LC mi$1.80, ph$1.80 PB 136 684

The work status and planned activity are discussed for the following sites; Verona, N. Y.; Baltimore, Md.; and Westinghouse Engineering Dept. At Verona, the FM transmission in the 2000-mc band was delayed by failure of the X-600 klystron. The power amplifier performed satisfactorily after the coolant in the klystron cooling system was changed to an alcohol-type antifreeze. Antenna pattern and gain measurements at 1840 mc indicated that the 2 side lobes are only 10 db down as compared to the normal 20 db down at this frequency. At Baltimore, the equipment for single antenna FM reception in the 2000-mc band employed a 7/8-in. Heliax coaxial transmission line until the flexible waveguide run could be installed. Antenna pattern and gain measurements were made on a 1700- to 2400-mc horizontally polarized feed horn at 1840 mc. The antenna gain was 43 db, and the beamwidth at the 3-db points in the horizontal plane was 1.4° for the main lobe. At Westinghouse, activities were concerned with (1) a comprehensive test program of the Verona-Baltimore link, (2) modifying a 960-mc FM transmitter and 2 receivers for FM operation in the 2000-mc band; and (3) designing and building an SSB transmitter and a dual diversity receiver for operation in the 2000-mc band. The modification phase of the program was completed.

Westinghouse Electric Corp., Baltimore, Md.
SATURABLE PULSE REACTORS AND RADAR MODULATORS, by C. E. Carter, Jr. Final development rept. 8 July 54-15 Feb 56, on Contract DA 36-039-sc-63124. 85p. 24 refs.
Order from LC mi$4.80, ph$13.80 PB 136 016

A radar modulator is a device for applying high voltage, high current pulses of short duration to a radio frequency generator such as a magnetron or klystron.

The modulators developed during this project use saturable reactors to generate the pulses. The modulators operate from an alternating source of frequency f and voltage E. The voltage is applied to a capacitor through a linear charging reactor which is resonant with the capacitor at the input frequency. When the charge on the capacitor reaches a peak value, a saturable reactor saturates allowing the capacitor to form a pulse in a manner similar to the thyratron in a tube modulator.

Mechanical Engineering

Wichita U. Foundation for Industrial Research, Kans.
INVESTIGATION OF GRAVITY FED VAPORIZING TYPE BURNERS, by R. L. Barns and L. L. Lyon. Final rept. vol. 1 on Contract DA 44-109-qm-982. Mar 54, 47p, AD-205 299.
Order from LC mi$3.30, ph$7.80 PB 136 134

Wichita U. Foundation for Industrial Research, Kans.
INVESTIGATION OF GRAVITY FED VAPORIZING TYPE BURNERS, VOLUME II, by R. L. Barns and L. L. Lyon. Final rept. on Contract DA 44-109-qm-982. Mar 54, 89p. AD 205 300.
Order from LC mi$4.80, ph$13.80 PB 136 133

Ordnance, Missiles, and Satellite Vehicles

Air Force Cambridge Research Center, Bedford, Mass.
EVALUATION OF AN/GMD-2 WIND SHEAR DATA FOR DEVELOPMENT OF MISSILE DESIGN CRITERIA, by Norman Dvoskin and Norman Sissenwine. Apr 58, 82p. 16 refs. Air Force Surveys in Geophysics no. 99; AFCRC TN-58-259; AD-152 495.
Order from LC mi$4.80, ph$13.80 PB 137 004

Vertical wind shear data obtained from forty-nine AN/GMD-2 soundings performed at L. G. Hanscom Field, Bedford, Massachusetts and Grenier Air Force Base, New Hampshire are analyzed. Brief descriptions of the AN/GMD-1 and AN/GMD-2 sounding equipment are presented, and the increased accuracy in measuring wind speeds and derived shears with the new AN/GMD-2 equipment is discussed. The possibility of measuring winds averaged through a 1-minute time interval with the new equipment rather than the conventional 2-minute interval is also investigated. Wind shears observed through 1000-, 3000-, and 5000-foot thicknesses are considered, and the relationship of these shears to the wind speed and height is studied. An attempt is made to present the derived wind shear data in a form suitable for direct missile design applications. This consists of frequency tabulations and percent occurrence of 1000-, 3000-, and 5000-foot shears as well as the 1-percent occurrence shears at the level of strongest wind.

Air Force Missile Development Center, Holloman AFB, N. Mex.
LABORATORY AND FLIGHT TESTS OF CHEMICAL TRACKING AIDS PERFORMED FOR PROJECT 6875 DURING PERIOD AUGUST 1954 THROUGH SEPTEMBER 1956, by Donald L. Ekstedt. July 58, 106p. AFMDC TR-58-2; AD 123 736.
Order from mi$5.70, ph$16.80 PB 136 698

Laboratory and flight testing of liquid smoke agents, white and collored, and experimental smoke generators for acquisition and tracking of aircraft and missiles are reported. Fluids reported included petroleum oils, silicone oils, dye solutions, titanium tetrachloride, phosphorus dispersions and solutions, and phosphorus-sulfur solutions. Successful smoke flights on F-86, F-94 and F-100 type aircraft are described.

Air Force Missile Development Center, Holloman AFB, N. Mex.
PERFORMANCE OF THE BALLOON LAUNCHED HYPERSONIC TEST VEHICLE, HTV I, IN VERTICAL DESCENT, by Hermann O. F. Scharn. June 58, 18p. AFMDC TN-58-9; AD-154 101.
Order from LC mi$2.40, ph$3.30 PB 135 877

A calculation is presented of the scope of Mach and Reynolds numbers obtainable by the hypersonic test vehicle HTV I in vertical descent after release from a balloon at altitudes up to 125,000 feet, where the time delay between release and ignition of the rocket motor is regarded as a second parameter.

Army Chemical Warfare Labs., Army Chemical Center, Md.
GENERATOR, SMOKE, MECHANICAL, PULSE JET, E19R5, by Albert G. Goldberg. Final engineering test no. 152. Aug 58, 41p. 5 refs. CWLR 2233.
Order from LC mi$3.30, ph$7.80 PB 136 772

Tests were conducted to ascertain whether the Generator, Smoke, Mechanical, Pulse Jet, E19R5, was adequately designed to provide an efficient and reliable means of producing smoke under conditions encountered in field-type usage.

[Army] Chemical Warfare Labs., Army Chemical Center, Md.
HELIUM GUN FOR PROPELLING VARIOUS SHAPED AND WEIGHTED MISSILES, by George M. Stewart. Technical rept. for June 53 - Mar 56. 16 Nov 56, 24p. 1 ref. Chemical Warfare Labs. rept. no. 2076
Order from LC mi$2.70, ph$4.80 PB 139 350

Described are (1) a gun using helium as a propellant which can propel various types and sizes of missiles

at low velocities with acceptable orientation and small dispersion in velocity at the same pressure, and (2) a modified Benjamin air pistol for propelling very small spheres and cylinders at relatively low velocities. The helium gun and modified Benjamin air postol afford a method of ballistically evaluating items such as clothing, lenses, major animal tissue and organs, synthetic yarns, and steel and copper wire. Previously, these items could not be evaluated against impact of very small, odd-shaped missiles at low velocities.

Army Engineer Research and Development Labs., Fort Belvoir, Va.
MINE PLANTING AID, TRUCK-MOUNTED EARTH DRILL, by W. Allen Cook and Harry C. Smith. 30 Apr 57, 34p. Rept. 1477-TR; AD-133 217.
Order from LC mi$3.00, ph$6.30 PB 136 187

Engineering tests were conducted on a truck-mounted, 8-hp McCulloch earth drill designed as a mine-planting aid and equipped with a counterbalanced auger mount attached to a 1/4-ton truck. The earth drill is for mounting principally on a 1/4-ton truck, but it can be mounted on other vehicles by the use of an intermediate adapter. When operated on the 1/4-ton vehicle, the drill is capable of drilling a hole up to 12 in. deep with any diameter up to 18 in. when equipped with the proper auger. Detached from the mount, the drill is capable of drilling a 9-in. -diam hole up to 36 in. deep in most soils. The tests included familiarization and operation, performance in both tillable and nontillable soils, mechanical reliability, mobility, actuation, interchangeability, military characteristics, and safety. The McCulloch earth drill is regarded a simple, easy-to-operate device for drilling holes suitable for all US mines. The drill is rugged and sufficiently reliable for military service. About 97 holes/hr can be drilled in average soils on a continuous basis by a 3-man crew. It is easier to use and faster than hand digging, effecting a labor advantage of about 3.6:1.

Army Rocket and Guided Missile Agency, Redstone, Ala.
EQUATIONS FOR TRANSFORMATION OF POSITION AND VELOCITY OF A PROJECTILE BETWEEN SEVERAL SYSTEMS OF COORDINATE MEASUREMENT, by Everett L. Gilman. 24 Mar 58, 72p. 3 refs. Rept. no. 6R6F.
Order from LC mi$4.50, ph$12.30 PB 137 044

Equations are presented for the transformation of both position and velocity components between rectangular X, Y, rectangular ξ, η, polar-launch, polar-earth, and polar-displaced coordinate systems. Incremental relationships between several of these systems, and equations for various special cases of transformation are also given.

Army [Rocket and Guided] Missile Agency [Redstone], Ala.
SLOSHING PHENOMENON AND THE MECHANISM OF A LIQUID IN MOTION IN AN OSCILLATING MISSILE CONTAINER, by Werner Eulitz. 30 Oct 57, 36p. 10 refs. Rept. no. DS-R-31.
Order from LC mi$3.00, ph$6.30 PB 136 417

This report is concerned with the behavior of a liquid in an oscillating container. This behavior is characterized by the liquid amplitudes to be expected and the depth of the oscillating liquid. This enforced oscillation is of great importance in a missile using liquid propellants and has been given the general term of "sloshing." The report is concerned with the damping of the sloshing and the stabilization of the liquid by suppression of the liquid motion.

Army [Rocket and Guided] Missile Agency, Redstone, Ala.
STABILITY AREAS OF MISSILE CONTROL SYSTEMS, by Walter Haeussermann. 27 Feb 56, 37p. 3 refs. Rept. no. 1R11.
Order from LC mi$3.00, ph$6.30 PB 137 667

In this report, areas of stability are derived for missle control systems with linear and nonlinear servo components. Methods are shown to adapt signal phase shifting networks to the properties of the missile and a selected servo system. The investigations are extended to missile motions around its center of gravity and about a prescribed line of flight.

Army Signal [Research and Development Lab.] Fort Monmouth, N. J.
PRECISION FREQUENCY CONTROL FOR GUIDED MISSILES, by E. A. Gerber. 29 July 57, 31p. 4 refs. Engineering rept. no. E-1210.
Order from LC mi$3.00, ph$6.30 PB 137 473

This report presents information on representative frequency control requirements for guided missile applications and discusses what can be done to meet these requirements. The various controls and guidance systems used in missiles are not within the scope of this report.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
GENERALIZED BALLISTIC FORCE SYSTEM, by Charles H. Murphy and John D. Nicolaides (BuOrd). May 55, 31p. 19 refs. Rept. no. 933.
Order from LC mi$3.00, ph$6.30 PB 139 623

The dependence of the aerodynamic force and moment acting on a missile in free flight on the past history of the missile's motion has been omitted from the Ballistic Theory and only partly considered in the Aerodynamic Theory. In this study the linear terms arising from a consideration of the forces and moments due to acceleration effects are added to the theory of motion. The resulting equations of motion and their solutions yield a more physically complete system, useful to both ballisticians and aerodynamicists in understanding the free flight performance of symmetrical missiles. The expansion of the transverse force and moment for a missile possessing a plane of mirror symmetry is given in an appendix.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
ULTRA-FAST FLASH X-RAYS FOR MULTIPLE RADIOGRAPHY, by Harold I. Breidenbach. Mar 49, 24p. 6 refs. Rept. no. 678.
Order from LC mi$2.70, ph$4.80 PB 136 424

This report explains a method for obtaining x-ray flashes having a time duration of the order of one-tenth of a microsecond. In addition, it shows how three successive tenth microsecond radiographs of the same detonation may be taken on separate films. Included herein are circuit diagrams, schematics, illustrations, and functional explanations of the main units and their associated equipment. Accompanying the circuit diagrams and schematics are brief functional descriptions.

Diamond Ordnance Fuze Labs., Washington, D. C.
PRELIMINARY FIELD TEST OF A SHORT PULSE RADAR RANGEFINDER, by James Salerno. 25 June 57 16p. TM-57-5.
Order from LC mi$2.40, ph$3.30 PB 137 666

Preliminary tests were performed at the Aberdeen Proving Grounds on 13-14 June 1957 to determine the feasibility of utilizing the DOFL Short Pulse Radar as a tank rangefinder. A DOFL SPR mounted in a truck and utilizing single antenna operation was used to determine the range to various targets on a range provided by the Ballistics Research Laboratory of APG.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
CALCULATION OF EXPLOSION PRODUCTS AT EQUILIBRIUM BY ANALOG COMPUTER, by August G. Edwards and Arthur I. Rubin. Aug 58, 24p. 2 refs. Technical rept. 2529.
Order from LC mi$2.70, ph$4.80 PB 137 578

The use of the analog computer in the solution of the theoretical equations that are used in calculating the explosion or isochoric adiabatic flame temperature of explosives is described. The computer is used to solve a set of non-linear simultaneous equations which are the result of a series of algebraic simplifications of the equilibrium equations. The solutions of these equations are used to calculate the combustion products and these values are in turn used to calculate the explosion temperature. The technique by which these particular non-linear simultaneous equations were handled on the computer can also be applied to the solution of other equations of this general type.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DEVELOPMENT AND EVALUATION OF NEW NITROMETER REACTION BULB, by Milton Roth, Raymond F. Wegman, and George Albansoder. Nov 58, 13p. 10 refs. Technical rept. no. 2579; AD-203 400.
Order from LC mi$2.40, ph$3.30 PB 138 407

A new reaction bulb for the Du Pont nitrometer has been developed because difficulty has been encountered in evaluating samples of certain types of materials in the conventional reaction bulb. In the new bulb, the sample can be introduced directly, and the acid can be added later. In this way, low test results due to premature decomposition can be avoided.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DEVELOPMENT OF A NUCLEAR TIMER FOR SATELLITE APPLICATION, by Martin Lazarus and Chester L. Smith. Sep 58, 16p. 3 refs. Technical rept. 2564.
Order from LC mi$2.40, ph$3.30 PB 137 764

A nuclear timer was developed to produce a time delay in the range of 45 to 60 minutes. This unit, which incorporates a self-contained power supply, is capable of reliably firing a pyroswitch or detonator at the termination of the delay period. It can be initiated remotely by means of a low-energy pulse and can be continuously tested without ill effect before application is made. This device provides a delay interval which is reproducible within ±1% and holds this tolerance under adverse environmental conditions.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
EFFECT OF WATERVAPOR TRANSMISSION RATE ON CORROSION RATE, by Roswell H. Evans and Theodore Fruchtman. Dec 58, 18p. 4 refs. Technical rept. no. 2580; AD-205 191.
Order from LC mi$2.40, ph$3.30 PB 138 415

A new method for relating the rate of corrosion of packaged ferrous items to the watervapor transmission rate of the material in which they are packed has been developed. Materials of a wide range of watervapor transmission rates were simulated by using bags in which a specific number of small holes had been punched. The time required to reach critical moisture content (60% RH) was determined, and a chart summarizing the results was prepared. The 60% RH level was chosen as representing critical moisture content on the basis of available data and literature. Above the 60% level, the rate of corrosion increases markedly.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
EVALUATION OF LIGHT-GAUGE ALUMINUM CONTAINERS FOR SMALL ORDNANCE ITEMS, by Richard DeVore. Sep 58, 15p. Technical rept. 2552.
Order from LC mi$2.40, ph$3.30 PB 136 401

Light-gauge slip-cover aluminum containers were evaluated by means of physical tests (quick leak, drop, vibration, rough handling) for determination of desirable properties. The test results indicated that these containers would be generally satisfactory for use as shipping containers for small Ordnance components.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
EVALUATION OF PLASTIC JARS FOR ORDNANCE

USE, by Richard H. DeVore. Nov 58, 17p. Technical rept. no. 2574.
Order from LC mi$2.40, ph$3.30 PB 138 414

Object was (a) to determine whether jars made of three different plastic materials (polystyrene, polyethylene, and cellulose acetate) can be used satisfactorily for the storage and shipment of small parts for Ordnance items; and (b) to evaluate such jars for compliance with Method IA13, Spec, MIL-P-116C.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
AN IMPROVED CALCULATION OF THE EXPLOSION TEMPERATURE, by Manfred R. Von Stein and Jack Alster. Aug 58, 21p. 10 refs. Technical rept. 2501.
Order from LC mi$2.70, $4.80 PB 138 433

Accurate determination of the explosion or isochoric adiabatic flame temperature of an explosive often involves a series of tedious calculations of the equilibrium composition of the explosion products at several temperatures. This report presents a new method which offers a simple general treatment for arriving at equilibrium compositions for C-H-N-O type explosives of any oxygen balance. A novel feature of the method is that the explosion temperature is determined directly from the know heat of combustion of the explosive rather than from its heat of explosion. This circumvents an often iterative calculation of the latter.

[Feltman Research and Engineering Labs.] Picatinny Arsenal, Dover, N. J.
INFRARED METHOD FOR DETERMINING TOLUENE, o, m & p NITROTOLUENE, 2, 4- & 2, 6-DNT, AND 2, 4, 6- TNT IN ADMIXTURES, by Walter E. Fredericks and Frank Pristera. Mar 58, 13p. 5 refs. Technical rept. 2485.
Order from LC mi$2.40, ph$3.30 PB 135 566

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
INFRARED METHOD FOR DETERMINING 2, 4- AND 2. 6-DINITROTOLUENE; 2, 4, 6-TRINITROTOLUENE; AND O- AND P-NITROTOLUENE IN ADMIXTURES, by Walter E. Fredericks and Frank Pristers. Oct 58, 11p. 5 refs. Technical rept. 2546.
Order from LC mi$2.40, ph$3.30 PB 137 467

An infrared spectrophotometric method of analysis has been developed for determining the amounts of 2, 4-dinitrotoluene (2, 4-DNT); 2, 6-dinitrotoluene (2, 6-DNT); 2, 4, 6-trinitrotoluene (a-TNT); ortho nitrotoluene (o-MNT); and para nitrotoluene (p-MNT), in admixtures. The concentrations used in the four samples evaluated ranged from 21. 3% to 61. 9% for 2, 4-DNT; from 19. 8% to 33. 5% for 2, 6-DNT; from 1. 5% to 19. 7% for 2, 4, 6-TNT; from 1. 6% to 19. 7% for o-MNT; and from 1. 5% to 19. 5% for p-MNT.

Louis Comfort Tiffany Foundation, Oyster Bay, N. Y.
VISIBILITY OF TARGETS, by Selbert Q. Duntley. Rept. on Contract OEMsr-597. Oct 45, declassified 15 Sep 54, 67p. OSRD-6401; ATI-25 170.
Order from LC mi$3.90, ph$10.80 PB 139 533

This report provides data for the determination of the maximum visibility of targets of any size, shape, color and brightness when seen against any background for the entire range of brightnesses from that of the moonless night sky to that of the brightest day.

Naval Ordnance Lab., Corona, Calif.
POSITION-EVENT-TIME (PET) RECORDER, by D. E. Rowe and J. L. Day. Aug 58, 13p. NOLC rept. 419; NAVORD rept. 5924.
Order from LC mi$2.40, ph$3.30 PB 137 772

The PET Recorder was developed by NOLC for testing guided missile fuzing systems. It combines a recording oscillograph and a camera to produce a photographic record of a moving object and the received signals. The film record is used to determine the distance from the moving object to the instrument, the speed of the moving object, and its relative position with respect to the signals recorded by the oscillograph. The PET Recorder has a number of applications and is particularly useful for high-speed objects.

Naval Ordnance Lab., White Oak, Md.
DETONABILITY OF SOLID PROPELLANTS. I. TEST METHODS AND INSTRUMENTATION, by Adolph B. Amster, Raymond L. Beauregard and others. Progress rept. 3 Feb 58, 24p. 8 refs. NAVORD rept. 5788.
Order from LC mi$2.70, ph$4.80 PB 139 284

Standard shock sensitivity tests have been modified for use in the study of solid propellants. Target plate damage is used as the criterion for determining when a detonation has occurred. The use of this standard is validated by comparison with detonation velocity measurements. The methods used for damage and velocity studies and for establishing a scale of shock sensitivities are described. Results are reported for several standard explosives. This report deals only with results on explosives.

Naval [Propellant Plant] Indian Head, Md.
PENETRATION OF LIQUIDS INTO ORIENTED NITROCELLULOSE FILMS, by M. K. Bernett and E. D. Margolin. 20 May 58, 31p. 10 refs. Technical rept. no. 104; NAVORD rept. no. 5686.
Order from LC mi$3.00, ph$6.30 PB 136 238

The diffusion of liquid methanol, acetone, diethyl phthalate, and dibutyl phthalate into oriented nitrocellulose films was studied by a moving boundary method. The penetration was found to follow Fick's Law in every case except for the penetration of acetone parallel to the orientation in which case $x = kt$ instead of $x = (kt)^{1/2}$. In every case except acetone, the penetration perpendicular to the direction of orientation was found to be faster than the penetration parallel to the orientation. It is proposed that the anomalous behavior can be explained by assuming that the non-Fickian penetration occurs by a process of viscous flow rather than diffusion.

Naval Research Lab., Washington, D. C.
FACILITIES AND INSTRUMENTATION OF THE NRL HYPERVELOCITY LABORATORY, by S. O. Bailey, A. B. J. Clark and others. Interim rept. 16p. 9 refs. NRL rept. 5271; AD-212 988.
Order from LC mi$2.40, ph$3.30 PB 137 207

The NRL hypervelocity evacuated-range facilities, associated instrumentation, and newly developed light-gas guns have been used at this Laboratory for some time. The principal range used for terminal-ballistic studies can accommodate guns up to 25 ft in length and can be evacuated to pressures corresponding to altitudes of 250,000 ft. Two other evacuated ranges are currently in operation. One is designed for projectiles of two grams or less and can be evacuated to pressures corresponding to a 350,000-ft altitude. The third is of intermediate size and is used primarily for gun and instrument development studies. The large range is equipped with a photographing station capable of taking two projection shadowgrams of projectiles. This station is used in conjunction with a drum-type streak camera for velocity measurement with an inherent accuracy of 0.5 percent. The other ranges are equipped with a combination photographing, velocity-measuring system using a Fastax camera that measures projectile velocity to 0.1-percent maximum accuracy and also records the condition, orientation, and rate of tumble of an observed projectile. Two large light-gas guns have been operating in the evacuated ranges for some time. The largest is 37 mm, 60 cal and has accelerated projectiles weighing 30 grams to 3.2 km/sec and 6.8 grams to 5.0 km/sec. The other gun has a 1.1-in. pump section, a 50-cal launch tube, and has accelerated two grams to 5.4 km/sec. This gun is equipped with a variable-length pump section; preliminary results indicate that the gun's performance is not greatly affected by a sharp reduction in pump-section length.

Picatinny Arsenal, Dover, N. J.
AUTOMATIC INSPECTION DEVICE, FUZE, PD, M48A3, USING RADIOACTIVE MARKED FIRING PIN SUPPORT CUPS, by J. A. Parfitt. Mar 58, 11p. 3 refs. Technical rept. DE-TR: 1-58.
Order from LC mi$2.40, ph$3.30 PB 135 578

A method of marking the fuze support cup with silver 110. Selection of the silver isotope involved consideration of economics, health hazards, and availabilty of nuclides. The inspection process could be performed auto-mechanically, without requiring a skilled operator.

Picatinny Arsenal, Dover, N. J.
AUTOMATIC INSPECTION OF SMALL PARTS, by W. C. Sweney. Apr 58, 27p. Rept. no. DE-TR: 3-58.
Order from LC mi$2.70, ph$4.80 PB 135 979

Picatinny Arsenal, Dover, N. J.
EVALUATION OF SULFATE WOOD PULP NITROCELLULOSE FOR MANUFACTURE OF MEDIUM-WEB (0.050-INCH) SINGLE-BASE PROPELLANT, by J. S. Merten. Oct 58, 26p. 5 refs. Technical rept. DB-TR:12-58.
Order from LC mi$2.70, ph$6.30 PB 137 934

Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.
PRELIMINARY EVALUATION OF ULTRAHIGH-STRENGTH STEELS FOR RECOILLESS RIFLES, by C. M. Carman. Mar 58, 40p. 3 refs. Rept. R-1443.
Order from LC mi$3.00, ph$6.30 PB 137 933

Tensile, impact, and fatigue properties of ten commercial and experimental steels heat treated to 300,000 psi tensile exhibit good tensile ductility values. High silicon steels and copper-bearing steels exhibited good fatigue properties.

Rodman Lab., Watertown Arsenal, Mass.
EXPLORATION OF CERMETS FOR ORDNANCE STRUCTURAL APPLICATION, by John M. Woulbroun. Oct 58, 20p. 15 refs. Technical rept. no. RPL 41/3.
Order from LC mi$2.40, ph$3.30 PB 138 416

Investigation of the cermet systems, titanium carbide (TiC) and aluminum oxide (Al_2O_3) bonded with iron (Fe), nickel (Ni), cobalt (Co), aluminum (Al), and a cobalt, chromium, molybdenum alloy (Co-Cr-Mo) was undertaken using powder metallurgy techniques. The cermet compositions were 25, 50 and 75 volume percent of binder with each ceramic. Superior strengths were developed with the TiC-Co, TiC-Fe, TiC-Ni, Al_2O_3-Fe, and Al_2O_3-Co systems. Various combinations of the materials exhibited promising properties as future potentially successful cermets for service at elevated temperatures.

Rome Air Development Center, Griffiss AFB, N. Y.
THREE-DIMENSIONAL ORTHOGONAL GRID SYSTEM OF RADC TRACKING RANGE, by Philip C. Swartz. June 58, 44p. 3 refs. RADC TR-58-78; AD-148 760.
Order from LC mi$3.30, ph$7.80 PB 137 564

This report describes the three-dimensional orthogonal grid system used in determining the position of airborne vehicles flying within the RADC four-station optical tracking range. The survey necessary to establish the grid system was performed by the U. S. Coast and Geodetic Survey. To date, no other tracking range in the United States has a higher order of accuracy, 1:187,000. Target position during an actual test run is determined by two computer methods consisting of a least squares procedure in which X, Y, Z position displacement is solved in one case and residual angular errors in the other. Present data reduction techniques take the following corrections into account: Orientation, collimation, refraction, tracking and weighting. Proper mathematical handling of this calibration data ensures target resolutions of extreme accuracy.

Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.
USE OF THE FARADAY EFFECT FOR DETECTION OF SMALL MAGNETIC FIELDS, by J. C. Feder and E. L. Offenbacher. Jan 58, 45p. 23 refs. Rept. R-1429.
Order from LC mi$3.30, ph$7.80 PB 136 569

The purpose of this study was to analyze magneto-optic effects, such as the Faraday rotation, and apply

this to crack or flaw detection in magnetic materials such as recoilless rifles. The magneto-optic effects discovered by Faraday, Cotton-Mouton, Voigt, Zeeman, and Kerr are discussed. A classical derivation is given of the Faraday rotation to emphasize the physical factors which determine the magnitude of the effect. Factors favorable for the enhancement of rotation are discussed with emphasis on multiple reflections. Criteria for the choice of parameters to obtain maximum sensitivity of detection are analyzed in detail, and notes on recent applications of magneto-optic phenomena are included. It is concluded that an instrument based on the Faraday rotation is feasible; however, extensive development would be required to evolve satisfactory test equipment for routine inspection.

Springfield Armory, Mass.
EMBRITTLEMENT OF Cr-Mo-V STEEL FROM CHROMIUM PLATING, by R. E. Bessey and W. M. Kisner. Rept. on Engineering and Development of Improved Small-Arms Barrel Assemblies, Contract DA 19-059-504-ORD-2698. 10 Feb 58, 35p. 4 refs. SA-TR19-1203.
Order from LC mi$3.00, ph$6.30 PB 138 425

An investigation was conducted to determine the extent of embrittlement of Cr-Mo-V steel resulting from chromium plating and the possible reduction of this embrittlement by subsequent heat-treatment. Tensile and tensile impact tests were made on Cr-Mo-V steel. Test procedures are described and results given.

Springfield Armory, Mass.
INVESTIGATION OF CHROMIUM PLATING CALIBER .30 BARREL BORES AND CHAMBERS AND HEADSPACING CALIBER .30 BARRELS HAVING CHROMIUM PLATED BORES AND CHAMBERS, by E. F. Koetsch. 16 Dec 57, 33p. SA-TR18-1055.
Order from LC mi$3.00, ph$6.30 PB 136 582

Barrels were electropolished and chromium plated in the bore and chamber of each. Information as to plating rates, relative plating rates between bore and chamber, and tolerances possible.

Springfield Armory, Mass.
PROTECTIVE FINISHES FOR CLIPS AND LINKS, by W. M. Kisner. 17 July 58, 12p. SA-TR18-1065.
Order from LC mi$2.40, ph$3.30 PB 137 939

Evaluation was made of the performance of fourteen finishing systems to determine the optimum protective finish for clips and links. All systems were evaluated by laboratory methods to determine ease of stripping rounds from a clip or a link. Tests indicate that the phosphate-waxed link is superior to the phosphate-oiled link with regard to reducing the stripping forces. Evaluating procedures are described, and results discussed.

Springfield Armory, Mass.
SANDBLASTING OF THE BORES OF BARRELS, GUN, AUTOMATIC, 20mm, M39, PRIOR TO CHROMIUM PLATING, by R. E. Bessey. 23 Sep 58, 55p. SA-TR1-7013.
Order from LC mi$3.60, ph$9.30 PB 137 132

Endurance life of the barrels that were abrasive blasted, with either sand or alumina, was no better than the life of the standard barrel.

Springfield Armory, Mass.
STATISTICAL EVALUATION OF THE ACCURACY OF RIFLE, CALIBER. 30, M1, SELECTED FOR NATIONAL RIFLE MATCHES, by R. F. Hoar and L. O. Spaulding. Jan 55, 14p. SA-TR-11-1083.
Order from LC mi$2.40, ph$3.30 PB 135 003

Watertown Arsenal Labs., Mass.
FEASIBILITY OF TITANIUM FOR WELDED MISSILES, by Carl E. Hartbower and George M. Orner. Aug 58, 24p. Rept. no. WAL TR 401/301.
Order from LC mi$2.70, ph$4.80 PB 138 760

A study has been made of the feasibility of welded titanium sheet for missile applications. Evaluation was based on short-time elevated-temperature tensile properties and a notch-tensile-impact test for notch sensitivity. Alloy types investigated were: Ti-4Al-2V complex (1Mo-1Cr-1Sn), Ti-6Al-4V and Ti4Al-2-1/2Sn. Welding was evaluated by the inert-gas-shielded tungsten-arc process with Ti-6Al-4V filler wire. Notch sensitivity was indicated to be a problem, particularly after welding.

Sanitation and Safety Engineering

Air Force Armament Center, Eglin AFB, Fla.
EVALUATION OF AERIAL SPRAY EQUIPMENTS. Armament Test rept. Aug 57, 20p. AFAC TR-57-78; AD-135 971.
Order from LC mi$2.40, ph$3.30 PB 137 974

The spray system as tested did not discharge sufficient amounts of DDT to cover the desired swath width with the required concentration. Wind speed, wind direction, and spray release altitude are the major factors affecting swath width, deposition rate, and therefore, concentration on the ground.

Army Chemical Corps Engineering Command, Army Chemical Center, Md.
DISPOSAL PROBLEMS OF CHLORINE PLANTS, by Neal P. Cochran and John W. Alker. Final rept. Aug 58 [172]p. 4 refs. Engineering Command rept. no. 25.
Order from OTS $3.00 PB 151 640

This report summarizes the results of tests conducted at Rocky Mountain Arsenal to solve the problem of disposal of hydrochloric acid generated at various Chemical Corps agent plants. Operation of methods of treatment of the brine to remove contaminants prior to electrolysis are described, and detailed operating instructions given. It is concluded that the treatment of contaminated brine and electrolysis is a feasible and economic operation for the Chemical Corps.

Army Engineer Research and Development Labs., Fort Belvoir, Va.
ION EXCHANGE FOR THE REMOVAL OF RADIONUCLIDES FROM WATER (SALTY DOG IX), by Don C. Lindsten, William J. Lacy and others. 7 Aug 57, 46p. 6 refs. Rept. 1492-RR.
Order from LC mi$3.30, ph$7.80 PB 136 482

The report concludes that: a. Ion exchange processes are feasible for use in the field by the Military for removing radionuclides from water. b. Ion exchange processes would best be reduced-to-practice in the form of a Mobile Ion Exchange Unit, as a supplementary and companion piece to the Mobile Water Purification Unit. The Mobile Ion Exchange Unit would normally be used after the Mobile Water Purification Unit, thus utilizing water that has been clarified and disinfected. c. In addition to removing radionuclides from water, a Mobile Ion Exchange Unit could be used for demineralizing saline sources, for softening, and for the removal of certain chemical and biological warfare agents.

Ship Building

Engineering Research Inst., U. of Michigan, Ann Arbor.
PRELIMINARY STUDY OF THE EFFECT OF DAMPING IN NONRIGID MACHINERY FOUNDATIONS, by R. N. Hamme. Rept. on Contract N6onr-232(19). 29 Feb 52, 48p. 8 refs. AD-9739.
Order from LC mi$3.30, ph$7.80 PB 139 620

Research was conducted on the shipboard problem of the acoustic detectability of rotating the reciprocating machinery. Noise radiated by the foundation structure of a small resiliently mounted machine was measured in a device resembling a resilient-mounting installation. A 1/40-hp dc shunt-wound electric motor was suspended from a 1/4- x 20- x 20-in. cold-rolled steel foundation plate having a pronounced natural frequency of bending vibration at 148 c. The plate was supported so that the 148-c resonance was almost completely undamped, while other plate resonances were partially suppressed to eliminate clutter by foundation resonances. Exciting forces were generated by dynamically unbalancing the motor with small weights attached to its shaft. Measurements were confined to the frequency range from 20 to 200 c. The test data showed a range of increased foundation vibration associated with each undamped foundation resonance. The relation between vibration decay rate and percentage of critical damping, comparison of experimental data with computed results, and comparison of effects of foundation resilience with wave effects in the mounts are discussed in appendixes.

Material Lab., New York Naval Shipyard, Brooklyn.
THE EFFECTS OF VARIATIONS IN THE GEOMETRY OF THE TEAR TEST SPECIMEN AS APPLIED TO THE EVALUATION OF NOTCH-TOUGHNESS OF SHIP PLATE STEELS, by E. A. Imbembo and F. Ginsberg. Final rept. 21 May 56, 51p. 16 refs. Lab. Projects 5152 and 5152-1.
Order from LC mi$3.60, ph$9.30 PB 137 009

Effects of variations in the geometry of the Navy tear specimen for the evaluation of the notch-toughness properties of ship plate steels. On the basis of tests made on 1" thick medium and high-yield steel plate, it is shown that the geometry of the tear specimen may be varied considerably without materially affecting the transition temperature. Modifications of the specimen design are proposed to permit the testing of plate of greater thickness than can be accomplished with the specimen of current design.

Reed Research, Inc., Washington, D. C.
MARINE PROPULSION, VOL. II. PHYSICAL PHENOMENA AND MARINE PROPULSION, by David W. Saltus and Robert Taggart. Rept. on Contract DA 44-177-tc-409. 15 July 57, 75p. 118 refs. Technical rept. on Proj. 9-97-40-000, Task 16; AD-148 484.
Order from LC mi$4.50, ph$12.30 PB 136 667

Reed Research, Inc., Washington, D. C.
MARINE PROPULSION, VOL. III. FISH PROPULSION BIBLIOGRAPHY, PATENTS AND OTHER SUPPLEMENTAL INFORMATION, by Seth Hawkins. Rept. on Contract DA 44-177-tc-409. 1 Sep 57, 33p. Technical rept. on Proj. 9-97-40-000, Task 16; AD-148 485.
Order from LC mi$3.00, ph$6.30 PB 137 014

Reed Research, Inc., Washington, D. C.
MARINE PROPULSION, VOL. IV. EXPERIMENTAL PROGRAM FOR EVALUATION OF SPINNING WHEEL PROPULSION SYSTEMS, by Robert Taggart. Rept. on Contract DA 44-177-tc-409. Oct 57, 22p. Technical rept. on Proj. 9-97-40-000, Task 16; AD-148 486.
Order from LC mi$2.70, ph$4.80 PB 137 012

Reed Research, Inc., Washington, D. C.
MARINE PROPULSION, VOL. V. EXPERIMENTAL AND DESIGN PROGRAM FOR HYDRAULIC JET PROPULSION DEVICES, by Robert Taggart. Rept. on Contract DA 44-177-tc-409. 15 Nov 57, 31p. Technical rept. on Proj. 9-97-40-000, Task 16; AD-148 487.
Order from LC mi$3.00, ph$6.30 PB 137 015

[Research Inst.] U. of Michigan, Ann Arbor.
A STUDY OF THE PROBLEM OF RESILIENT MOUNTING AGAINST A NON-RIGID FOUNDATION STRUCTURE, by R. N. Hamme. Rept. on Contract N6onr-232(11). 31 July 50, 33p. ATI-206 906.
Order from LC mi$3.00, ph$6.30 PB 138 137

This paper outlines a basic extension to the theory currently in use in the design of resilient mounts for machinery units aboard ship. The extension involves an investigation of the effect of foundation resilience on the isolation effectiveness of the resilient mounting system. A general formulation of the resilient mount-

ing problem has been outlined and a review of the design theory currently in use has been presented as the first approximation toward the solution of the general problem. This first approximation design theory assumes the foundation structure against which the resilient mounts are built up to be entirely rigid and immovable.

FOOD, HANDLING, AND PACKAGING EQUIPMENT

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
EVALUATION OF IMPROVED COMPACT BOX LUNCH: NUTRITIONAL CHARACTERISTICS, STABILITY, EASE OF FLIGHT KITCHEN PREPARATION, EASE OF HANDLING IN FLIGHT, AND ACCEPTABILITY OF COMPONENTS, by Beatrice Finkelstein, Robert G. Pippitt, and Albert A. Taylor. Rept. on Flight and Survival Foods, Feeding Methods and Nutritional Requirements. July 56, 53p. 6 refs. WADC Technical rept. 56-363 AD-97 127.
Order from LC mi$3.60, ph$9.30 PB 136 174

Packaging

Army Transportation Research and Engineering Command, Fort Eustis, Va.
REUSABLE, DEHUMIDIFIED CARGO CONTAINERS (A STUDY TO DETERMINE OPTIMUM CONTAINER SIZE) by Harold A. Ablett and Vernard A. Keerbs. Interim rept. no. 3 on Project 9-91-03-000, Task 302T. Dec 58, 101p. 7 refs. ATREC-3558; AD-203 962.
Order from OTS $2.50 PB 151 641

The report covers the size and configuration of the present Conex container and container system. It outlines the factors affecting container design; capacity, dimensions of cargo floors in transportation media, available overhead clearance, internal cube related to the maximum permissible gross weight, consideration of handling facilities throughout the transportation chain, and operation interest. Limitations of different lifting devices are considered in regard to containers, and an evaluation of different modes of transport (commercial and military) is included.

Container Labs., Inc., Washington, D. C.
CONTAINERS, CARGO, DEHUMIDIFIED, REUSABLE (EVALUATION AND TESTING OF BREATHING UNIT FOR CONEX CONTAINERS) by Paul J. Zerr and L. J. Pursifull. Interim rept. no. 2 on Contract DA 44-177-tc-364. July 58, 74p. DA Proj. 9-91-03-000, Task 302 T; AD-148 488.
Order from LC mi$4.50, ph$12.30 PB 136 137

Under Phase I of Contract DA 44-177-TC-364, an investigation was made for converting the military standard container (Conex) to an air and water-tight container. That study resulted in a recommendation that the container be permitted to breathe through a desiccant bed. Under Phase II of this contract, a testing and evaluation program was conducted to determine the rate of passage of air through the proposed breather unit, the ability of the system to absorb moisture from the atmosphere, and the effectiveness or "life" of the breather unit.

Material Lab., New York Naval Shipyard, Brooklyn, N. Y.
EVALUATION OF RUBBER-FABRIC MOLDED "FORTEX" BUCKETS SUPPLIED BY CAUCHOTEX INDUSTRIES, INCORPORATED, SAN JUAN, PURETO RICO, U. S. A. Final rept. 2 July 58, 7p. 3 refs. Lab. project 5983.
Order from LC mi$1.80, ph$1.80 PB 137 428

New York State Coll. of Forestry, Syracuse U.
EVALUATION OF GAS TRANSMISSION RATES OF FLEXIBLE PACKAGING MATERIALS, by V. Stannett, M. Szwarc, and A. W. Myers. Final rept. on Contract DA 19-129-qm-123. 30 Apr 58, 143p.
Order from OTS $2.75 PB 151 124

Studies were made on: Permeability of plastic films to oxygen, nitrogen, carbon dioxide and a discussion of factors affecting permeability; permeability of films to hydrogen sulfide gas; permeation, diffusion and solubility of methyl bromide and isobutene in polyethylene; effect of polymer crystallinity; permeability of plastic films to water vapor and the effect of relative humidity on gas permeability; permeability of irradiated and grafted polymer films to gases and vapors; effect of a paper substrate.

Olin Mathieson Chemical Corp., New Haven, Conn.
TESTING PROGRAM FOR IRRADIATED PACKAGING FILMS, by L. E. Simerl. Rept. no. 5 (Final) for 26 Sep 56-25 June 57, on Contract DA 19-129-qm-761. Sep 57, 30p. 4 refs.
Order from LC mi$2.70, ph$4.80 PB 139 596

This is the final report summarizing the results of a series of tests for determining the effects of irradiation on the physical characteristics of polymer coated 300 0X-511 cellophane.

Rock Island Arsenal Lab., Ill.
THE COMPATIBILITY OF CERTAIN BARRIER MATERIALS WITH VCI MATERIALS, by Evelyn S. Burke. Rept. no. 3, 21 July 58, 19p. 6 refs. Rept. no. 58-1868.
Order from LC mi$2.40, ph$3.30 PB 137 705

Barrier materials conforming to Specification JAN-P-117 and MIL-B-131 and volatile corrosion inhibitor fabrications conforming to MIL-P-3420 were assembled in various combinations by placing an insert of the VCI material in a heat sealed bag of the barrier material. Such assemblies were stored in enclosed

cabinets in an unheated attic storeroom and in an unsheltered area outdoors. Test results on critical properties of the barrier materials stored in contact with VCI are compared, after various storage periods, with the properties of like barrier materials stored under the same conditions, but not in contact with VCI materials. Periods of storage up to 42 months are covered. Certain types of VCI included in the program show incompatibility with the barrier materials, causing a high incidence of test failures. One of these types of VCI destroys the greaseproofness and moisture vapor transmission resistance of polyvinylidene chloride - kraft barrier laminations in less than 12 months contact.

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Engines and Propulsion Systems

Aerojet-General Corp., Azusa, Calif.
A PRELIMINARY INVESTIGATION OF AN ATOMIC-OXYGEN POWER PLANT, by Sterge T. Demetriades and Carl B. Kretschmer. Rept. on Contract AF 49(638)111. 4 Mar 58, 55p. 28 refs. Aerojet-General TN-23; AFOSR TN-58-325; AD-154 229.
Order from LC mi$3.60, ph$9.30 PB 137 008

Assuming 100% efficiency in utilizing the atomic-oxygen recombination energy, a thrust of 5.7×10^{-4} lbf per square inch of inlet area is obtained at an altitude of 100 km. This thrust is independent of the flight speed and depends on altitude only. Theoretical estimates indicate that the recombination of atomic oxygen can be effected in a continuous-flow (open-cycle) power plant by ram-compression alone, with a catalyst. About 50% of the available oxygen can be recombined by this method.

Bell Aircraft Corp. [Buffalo, N. Y.]
PROGRAM OF EXPLORATORY RESEARCH ON ROCKET ENGINE COMBUSTION, by Theodor G. Rossmann. Final rept. for 15 Sep 56 - 14 Sep 57 on Contract AF 18(600)1156. 15 Oct 57, 93p. 25 refs. AFOSR TR-58-17; AD-148 132.
Order from LC mi$5.40, mi$15.30 PB 136 418

The objective is to conduct exploratory research for the purpose of obtaining design criteria for liquid rockets which will permit a more rational approach to design of rocket engines. The primary subject of investigation is the phenomena which occur in the combustion chamber of a rocket. The investigation makes both theoretical and empirical approaches.

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
ANALYSIS OF EXTRACTED ORGANIC CONSTITUENTS CARBON DEPOSITS ON PISTONS (AUTOMOTIVE), by Charles B. Jordan. June 58, 18p. 6 refs. Rept. no. CCL #58.
Order from LC mi$2.40, ph$3.30 PB 135 572

The object of this study was to analyze the extracted organic portion of carbon deposits on the face of automotive pistons and to compare this portion with reference to a similar extract made from deposits taken from the upper piston ring groove.

David Taylor Model Basin, Washington, D. C.
PRESSURE BUILDUP DUE TO BURNING IN A VENTED CHAMBER, by George Chertock. July 57, 14p. 5 refs. Rept. 1048.
Order from LC mi$2.40, ph$3.30 PB 137 526

A theoretical analysis is made of the pressure buildup in a vented magazine in which a propellant is burning. Differential equations are derived relating the pressure and density of the gas to the rate of burning, heat of reaction, vent area, chamber volume, and time. The solutions of these equations indicate that for excess pressures in the magazine in the order of 15 to 20 psi, the peak excess pressure is directly proportional to the burning rate, inversely proportional to the vent area, and almost directly proportional to the heat of reaction. The peak pressure under these conditions is independent of the magazine volume. Under the same conditions, the time at which the peak pressure is reached varies mainly as the ratio of magazine volume to vent area. The theory does not predict the effective amount of afterburning.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
BURNING CHARACTERISTICS OF STANDARD PROPELLANTS BETWEEN 21°C AND -51°C, by Joel Harris and Lester Shulman. Nov 58, 38p. 8 refs. Technical rept. 2558; AD-202 577.
Order from LC mi$3.00, ph$6.30 PB 137 938

M2, M6, M9, M15, and M17 propellants were burned in closed bombs preconditioned at temperatures ranging in 11° intervals from 21°C to -51°C. Burning rate equations for the M2 and M9 propellants were derived from the experimental closed bomb tests.

National Advisory Committee for Aeronautics, Washington, D. C.
EFFECTS OF GROUND PROXIMITY ON THE THRUST OF A SIMPLE DOWNWARD-DIRECTED JET BENEATH A FLAT SURFACE, by Kenneth P. Spreemann and Irving R. Sherman. Sep 58. 39p. 2 refs.
Order from NASA NACA TN-4407

An investigation to determine the effects of some of the basic parameters on the thrust of a simple downward-directed jet beneath a lifting surface has been conducted in a static thrust facility at the Langley Aeronautical Laboratory. Some of the principal variables investigated were size and shape of the lifting surface and distance of lifting surface and nozzle exit above the ground. Devices to minimize the negative induced lift in close proximity to the ground also were investigated, and of all the devices tested a perforated plate raised slightly above the ground was the most effective.

National Advisory Committee for Aeronautics, Washington, D. C.
THEORETICAL AND EXPERIMENTAL ANALYSIS OF THE REDUCTION OF ROTOR BLADE VIBRATION IN TURBOMACHINERY THROUGH THE USE OF MODIFIED STATOR VANE SPACING, by Richard H. Kemp, Marvin H. Hirschberg, and William C. Morgan. Sep 58, 43p. 6 refs.
Order from NASA NACA TN-4373

Theoretical analysis indicates that the vibration excitation originating in the stator vane assemblies of turbomachinery can be reduced 68 percent by altering the circumferential positions of the individual vanes in a prescribed manner by amounts less than ±10 percent of the normal spacing. Experimental verification of the analysis was obtained by using an air-interrupter disk and measuring the amplitudes of vibration of turbine blades in a turbojet when two different stator vane assemblies were employed.

Rome Air Development Center, Griffiss AFB, N. Y.
DEVELOPMENT OF 10-KW ENGINE GENERATOR SET, TRAILER-MOUNTED, TYPE MB-5, by Frank J. Mollura. June 58, 38p. 4 refs. RADC TR-58-74; AD-148 753.
Order from LC mi$3.00, ph$6.30 PB 137 671

This report presents the results of a program initiated and developed by RADC to secure a power source for a mobile communication and navigation facility, designated Project Four Wheels. This power source is considered to be the first 10-kw diesel engine generator set to be developed for military use.

Scintilla Div., Bendix Aviation Corp., Sidney, N. Y.
DEVELOPMENT OF LOW VOLTAGE SHUNTED-SURFACE GAP IGNITER PLUGS FOR GAS TURBINES, by Thomas G. Brady, Millard E. Gage, and Robert C. Harris. Rept. for 1 Feb 56 to 31 Jan 57 on Contract AF 33(616)3292; continuation of Contract AF 33(600)15362. Oct 57, 155p. 7 refs. Scintilla Research Dept. rept. 8-8440-3; WADC Technical rept. 57-572; AD-131 073.
Order from OTS $4.00 PB 131 575

Improved designs and materials have been developed for shunted-surface gap jet igniter plugs. Pending confirmation by actual gas turbine test, available data indicates that several of the new designs will give substantially greater life than former plugs, together with extreme resistance to fouling and icing. The "best" design has operated over 500 starting cycles in the modified Greer burner used for laboratory testing. Descriptions are given of special ceramics techniques used to make semiconductive inserts, and of test results, test equipment, and the "best" design. Recommendations are made for additional gas turbine tests on the ground and in flight, with further laboratory research to continue in the direction indicated by such tests.

Naval Engineering Experiment Station, Annapolis, Md.
BASIC INFORMATION ON THE BEARING PROPERTIES OF VARIOUS MATERIALS IN LIQUID METALS, by W. J. Greenert and M. R. Gross. [1953] 27p. 12 refs. Rept. no. EES-090014A.
Order from LC mi$2.70, ph$4.80 PB 138 113

Load carrying capacity of SAE 52100 and 18-4-1 high speed tool steel in oil at 500°F. Superiority for the high speed tool steel was found. Effect of liquid solid-potassium alloys on laminated phenolic and glass laminated melamine plastics the maximum operating temperatures for these materials is 275°F. Liquid sodium-potassium is not detrimental to the fatigue properties of SAE 52100 steel.

New York U. Coll. of Engineering, N. Y.
REALISTIC EVALUATION OF THE FACTOR OF SAFETY IN A BOLTED BRACKET, by Bernard W. Shaffer. Technical rept. no. 4 on Contract NOrd-16497. Sep 57, 15p. 3 refs. AD-151 224.
Order from LC mi$2.40, ph$3.30 PB 136 416

A bolted bracket is analyzed when it is subjected to a pure bending moment of sufficient intensity to induce first an elastic, then an elastic-plastic, and finally a fully plastic stress distribution within the supporting set of bolts.

Rock Island Arsenal Lab., Ill.
PLASTIC-METAL BEARINGS, by T. Rice and T. Turner. 28 May 58, 19p. 47 refs. Rept. no. 58-1265.
Order from LC mi$2.40, ph$3.30 PB 137 767

Porous bronze sleeve bearings have been impregnated with PTFE and PTFCE plastic. Time, temperature rise and weight loss at failure have been determined for the various bearings. Failure was judged by noise level and excessive spalling of the bearings.

Shell Development Co., Emeryville, Calif.
GREASE LUBRICATION OF HIGH SPEED ANTI-FRICTION BEARINGS, by John B. Accinelli. Rept. for 1 Sep 55-30 June 56 on Lubricant Mechanical Evaluation, Contract AF 33(616)2443. Jan 57, 37p. WADC Technical rept. 55-102, pt. 3; AD-110 701.
Order from LC mi$3.00, ph$6.30 PB 139 000

Preliminary work with grease in the recently calibrated 20-mm high-speed rigs indicated that grease lubrication of lightly loaded high-speed ball bearings is significantly inferior to lubrication by oil; bearing operation with grease was impossible at 1.2×10^6 DN, while with oil-air mist lubrication continuous operation without failure for 100 hr was achieved. Reducing speed to 1.0×10^6 DN improved bearing operation with grease but did significantly prolong bearing life. A comparison of results from identical grease runs in the 20- and 25-mm rigs at 1.0×10^6 DN indicated that the 20-mm bearings are more difficult to lubricant than the 25-mm bearings. Calculations of various

characteristics of the bearings at a given DN for the 2 bearings show that the 20-mm bearing is more severe; the DN factor is not necessarily a good basis for comparing the performance of bearings of varying size. Additional work at 1.0×10^6 DN on the effect of the viscosity of the oil in the grease in the 20-mm rig with the improved housing indicated some beneficial effect of the heavier viscosity oil. During the 100-hr oil calibration tests, Plexol 201 fluid appeared to provide better lubrication than SAE 1010 mineral oil; the advantage of the Plexol 201 apparent with respect to the degree of bearings plated with thin films of grease resulted in good performance at start-up but short operating life. Evaluation of the 20-mm rig performance at 30,000 rpm (0.6×10^6 DN) with grease and at a 20-lb bearing load showed that operating conditions are less severe than at 50,000 rpm.

Manufacturing Equipment and Processes

Armour Research Foundation, Chicago, Ill.
BRAZING TITANIUM SANDWICH CONSTRUCTION, by John F. Rudy, Robert M. Necheles, and Harry Schwartzbart. Rept. for 1 July 57-30 July 58 on Metallic Materials, Contract AF 33(616)5357. Jan 59, [98]p. WADC Technical rept. 58-467; AD-207 904.
Order from OTS $2.25 PB 151 663

The purpose of this project was to study the feasibility of fabricating titanium alloy face sheet honeycomb sandwiches by brazing techniques. The program was conveniently divided into several phases: selection of face sheet alloy and brazing alloys, fabrication of sandwiches by various experimental methods, and mechanical evaluation of the resulting panels. The emphasis was placed on the second phase, fabrication processes. The survey of possible face sheet alloys is discussed in some detail. An evaluation of 17 brazing alloys as regards wettability, mechanical strength, oxidation resistance, and corrosion resistance resulted in the recommendation of Ag-28Cu-0.2Li and Ag-0.25Mg-0.2Ni-1Li as the best alloys for brazing titanium-cored panels at a brazing temperature of 1500°F. Ag-28Cu-0.2Li was the stronger of the two. These two alloys plus Ag-7Cu-0.2Li and Ag-30Cu-10Sn were found to be satisfactory for brazing stainless steel cored panel at 1600°F. Of these four alloys, Ag-28Cu-0.2Li and Ag-7Cu-0.2Li gave the strongest joints. The process development phase centered around the development of a quartz lamp radiant heat brazement process. The details of the process, as used, and a discussion of suggested modifications and improvements for application of the same principles to large-production panel fabrication, are presented. Although the process development experiments were conducted with titanium alloy face sheet materials, the results are applicable to sandwich panel production in general.

Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF HIGH-STRENGTH FILLER WIRES FOR WELDING SAE 4130, 4140, AND 4340 STEELS, by Herbert W. Mishler and Raeman P. Sopher. Rept. for 1 Mar 54 - 30 June 56 on Metallic Materials, Contract AF 33(616)2339. Apr 57, 76p. 7 refs. WADC Technical rept. 56-550; AD-118 210.
Order from OTS $2.00 PB 131 074

Filler wires were developed for welding high-strength low-alloy aircraft steels by the inert-gas tungsten-arc and inert-gas consumable-electrode processes. The major factors that were considered in the evaluation and development work were: (1) weld-metal porosity, (2) weld-metal cracking tendency, (3) heat-treatment response compared with base metal, (4) strength of heat-treated weld joint, (5) weld-metal toughness, and (6) weld-metal hardenability. Two filler wires were developed for welding each of the three steels, SAE 4130, 4140, and 4340. One of each pair of filler wires had a composition similar to the base material, while the other was of a dissimilar composition. Sound, crack-free welds, heat treatable to 200,000 psi were deposited under a high degree of restraint with all these filler wires. The best results were obtained with the filler wires of compositions similar to the base material, although satisfactory welds were made also at most of the strength levels with the dissimilar filler wires.

Carnegie Inst. of Tech. Graduate School of Industrial Administration, Pittsburgh, Pa.
DERIVATION AND COMPUTATION OF LINEAR DECISION RULES FOR PRODUCTION AND EMPLOYMENT SCHEDULING, by Charles C. Holt, Franco Modigliani, and John F. Muth. Research memo. no. 36 on Planning and Control of Industrial Operations, Contratt Nonr-760(01). Oct 55, 33p. 6 refs.
Order from LC mi$3.00, ph$6.30 PB 125 032

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
WELDING AND BRAZING OF MOLYBDENUM, by N. E. Weare and R. E. Monroe. Rept. on Contract AF 18(600)1375. 1 Mar 59 [47]p. 44 refs. DMIC rept. 108; AD-210 486.
Order from OTS $1.25 PB 151 063

This report is a summary of available information on the welding and brazing of molybdenum as it applies to joining of structural components by the Defense Industry. The metallurgical considerations involved in joining molybdenum are discussed, as well as testing, cleaning, and joining procedures. A survey of the published literature revealed considerable information of value to designers and materials and process engineers, although only a limited amount of this information has been reported as standardized engineering data.

Lessells and Associates, Inc., Boston, Mass.
DESIGN, CONSTRUCTION AND PARTIAL PROOF TESTING OF HIGH-FREQUENCY DIRECT-STRESS FATIGUE-DAMPING MACHINE, by Paul R. Shepler and William E. Nicholson. Technical rept. no. 4 on Dynamic Properties of Materials, Contract N7onr-468(01). 30 Dec 49, 182p. 18 refs. ATI-151 385.
Order from LC mi$8.40, ph$28.80 PB 136 188

Contents:
Nomenclature
Introduction
Machine design and construction
Model vibrator design and model tests
Instrument design and construction
Lower diaphragm tests
Matching procedure for upper diaphragm and specimen systems
Fatigue tests on three-degree-of-freedom machine including rematching procedure
Attempted hysteresis gage tests on three-degree-of-freedom machine
Hysteresis gage tests on two-degree-of-freedom machine
Preliminary design, construction and test of one-degree-of-freedom machine
Results and discussion
Recommendations and conclusions
Acknowledgments
References

Office of Ordnance Research, Durham, N. C.
PROCEEDINGS OF ORDNANCE CONFERENCE ON OPERATIONS RESEARCH [NO. 3] HELD AT ORDNANCE WEAPONS COMMAND, ROCK ISLAND ARSENAL, 24-25 MAY 56. 1956, 118p. 209 refs. Rept. no. 57-3.
Order from LC mi$6.00, ph$18.30 PB 139 625

The following papers were presented:
A philosophy of management, by T. A. Weyher
Operations research and automation science, by Merrill M. Flood
Work sampling, by Robert B. Andrews
On the retention or disposal of excess stocks, by Carl James Sinke
Solution of theory of games air duels, by Richard Sacksteder
The role of operations research at Redstone Arsenal, by Paul L. Gurnee
Operations research applied to arsenal problems, by Herbert P. Galliher

Rodman Lab., Watertown Arsenal, Mass.
NEW BASIS FOR AN INSPECTION METHOD FOR SINTERED METAL COMPONENTS, by Bennett Bovarnick. Mar 58, 93p. Rept. no. RPL 41/2.
Order from OTS $2.25 PB 151 133

A basic engineering investigation was undertaken to establish the requirements of a nondestructive test as a 100% inspection method for in-process quality control and acceptance testing of sintered metal parts. Based upon the principle that the surface energy of a material is dependent upon its surface character, a series of specimens were processed by industrial methods and the engineering properties were determined. Specimens were tested by measurement of the electrochemical potential.

Southern Calif. Labs., Stanford Research Inst., South Pasadena.
RETROFIT APPLICATIONS OF NUMERICAL CONTROLS FOR MACHINE TOOLS, by Peter D. Tilton. Rept. on Contract NOas 57-101-c. Dec 57, 113p. 46 refs. SRI proj. no. IU-1896.
Order from LC mi$6.30, ph$18.30 PB 136 131

At the outset it is important to clarify the distinction between numerical control as an over-all method or concept and numerical controls as the physical equipment which implements the method by controlling the machine tool. Although this report is concerned primarily with those equipment characteristics and capabilities that are typical of retrofit applications, it is impossible to avoid considering the attributes of the method itself, especially where economic evaluation is desired. Many important aspects of the method apply equally well to all systems, whether in new tool or retrofit applications. These have been taken into account whenever pertinent, but it has not been practical to treat fully all aspects of numerical control which would be important to a potential retrofit user.

Springfield Armory, Mass.
RECLAMATION OF INDUSTRIAL DIAMONDS FROM DIAMOND GRINDING WHEELS, by K. A. Jorczak. 23 Apr 58, 10p. SA-TR20-7001.
Order from LC mi$1.80, ph$1.80 PB 137 887

An investigation was conducted to determine an efficient and economical procedure by which industrial diamonds can be reclaimed from the bonding matrices by electrochemical process. This process is applicable to diamond dressing and forming tools, and only to grinding wheels that are electroconductive. The suggested procedure is given.

Springfield Armory, Mass.
RECLAMATION OF INDUSTRIAL DIAMONDS FROM SEGREGATED SWARF OR SLUDGE, by K. A. Jorczak. 24 June 58, 8p. SA-TR20-7002.
Order from LC mi$1.80, ph$1.80 PB 137 885

An investigation was conducted to determine an efficient and economical procedure by which industrial diamonds can be reclaimed from swarf or sludge collected from exhaust systems of grinding machines used exclusively for diamond grinding. The suggested procedure is given.

Watertown Arsenal Labs., Mass.
STEEL CASTING REQUIREMENTS FOR ORDNANCE TEXT OF A PAPER PRESENTED TO THE STEEL FOUNDERS' SOCIETY OF AMERICA AT THE 11TH ANNUAL TECHNICAL AND OPERATING CONFERENCE, 8 NOVEMBER 1956, by P. V. Riffin. Nov 57, 29p. 4 refs. Summary rept. no. WAL 311/38.
Order from LC mi$2.70, ph$4.80 PB 137 399

A summary of the technical requirements and some of the problems associated with obtaining cast steel for Ordnance equipment. Recent developments in nondestructive testing and use of laboratory tests for controlling the quality of production castings are also included.

Army Transportation Research and Engineering Command, Fort Eustis, Va.
REMOTE CONTROL DEVICES FOR SHIPS' ELECTRIC CARGO WINCHES, by Emile H. Brie, Sr. and Robert R. Burke. Final rept. on Contract DA 44-177-tc-300. Sep 58, 17p. Proj. 9-87-14-000, Test T-10; AD-148 496.
Order from LC mi$2.40, ph$3.30 PB 136 742

The report covers the investigative efforts involved in the search for a remote control device which would permit remote control operation of 5-ton electric cargo winches on U. S. flag cargo vessels. A remote control device was procured and tested in cargo handling operations. It was concluded that the installation of the device on U. S. flag cargo vessels would result in economy of time and manpower as well as safer loading and discharge of cargo, particularly during in-stream operations.

Army Transportation Research and Engineering Command, Fort Eustis, Va.
RIGGING SHIP'S GEAR FOR HANDLING CONTAINERIZED CARGO, by Lee I. Luther. Sep 57, 51p. 5 refs. Proj. 9-97-40-000, House Task 14.16; Research Technical memo. RTM 22; AD-120 510.
Order from LC mi$3.60, ph$9.30 PB 137 542

With the adoption of the metal shipping box (cargo transporter), it became possible to ship unit loads weighing as much as 5 long tons. However, all elements of existing ship's gear are not adequate for handling these containers. RTM 22 discusses the methods of preparing and utilizing rigging gear for safely handling heavy lifts. In addition, this memorandum contains a stress analysis of yard and stay methods. The analysis explains the basic principles behind the methods which are recommended for use when heavy lifts are to be handled.

Army Transportation Research and Engineering Command, Fort Eustis, Va.
STUDY OF FEASIBILITY OF TRAILER-ON-FLATCAR RAILWAY TRANSPORTATION, by Harold A. Ablett and Vernard A. Keerbs. Aug 58, 92p. 32 refs. AD 148 497.
Order from OTS $2.00 PB 151 303

This report presents a survey of current domestic commercial trailer-on-flatcar (TOFC) operations and then analyzes the advantages and disadvantages of employing trailer-on-flatcar transportation in the military system. TOFC, colloquially known as "piggyback", involves the movement of semitrailers, complete with running gear, on specially designed or modified railway flatcars. The report concluded that logistic planning should provide for the utilization of TOFC technique in both the United States and overseas theaters but that transoceanic movement appears impracticable for adoption in the military system.

Bureau of Yards and Docks, Washington, D. C.
RAILROAD TRACK MAINTENANCE FORMULAS. Engineered Performance Standards, Public Works Maintenance. Aug 58, 181p.
Order from LC mi$8.40, ph$28.80 PB 139 131

Bureau of Yards and Docks, Washington, D. C.
RAILROAD TRACK MAINTENANCE HANDBOOK. Engineered Performance Standards, Public Works Maintenance. Aug 58, 85p.
Order from LC mi$4.80, ph$13.80 PB 139 132

Land Locomotion Research Branch, Ordnance Tank-Automotive Command, Center Line, Mich.
A DEFINITION OF SOIL TRAFFICABILITY, by M. G. Bekker. June 58, 36p. 17 refs. Rept. no. 41.
Order from LC mi$3.00, ph$6.30 PB 137 576

Available definitions of soil trafficability used in mobility evaluation and forecasting are qualitative and incompatible with applied mechanics. In this paper an attempt has been made to define soil trafficability in terms of thrust/load ratio which is similar in concept to the idea of the "navigability" of a fluid expressed in terms of lift/drag ratio. To this end soil thrust has been expressed in terms of the ultimate soil strength as defined by Coulomb-Mohr criterion, minus motion resistance due to soil compaction, while soil load has been assumed as a function of the moduli of soil deformation which occurs for the given sinkage of the unit area.

Land Locomotion Research Branch, Ordnance Tank-Automotive Command, Center Line, Mich.
EVALUATION OF TIRES FOR THE XM 410 8X8 2 1/2 TON TRUCK, by I. R. Ehrlich. Jan 58, 13p. Rept. no. 26.
Order from LC mi$2.40, ph$3.30 PB 138 163

Land Locomotion Research Branch, Ordnance Tank-Automotive Command, Center Line, Mich.
A NEW BOOSTER OF LIFT AND THRUST FOR AMPHIBIAN VEHICLE, by Ferenc Pavlics. May 58, 48p. 7 refs. Rept. no. 32.
Order from LC mi$3.30, ph$7.80 PB 137 575

Amphibian vehicles lack mobility in water, particularly, when landing or descending into the water. To overcome this deficiency a paddle track was conceived as a booster of lift and thrust. Preliminary tests indicate certain advantages which this device may possess over such conventional solutions as buoyant floats, screws, or hydrojets. Further detailed investigations of the idea appear advisable and may be most promising when designing new amphibian vehicles.

Land Locomotion Research Branch, Ordnance Tank-Automotive Command, Center Line, Mich.
OBSTACLE PERFORMANCE OF WHEELED VEHICLES, by George P. Rettig and M. G. Bekker. Mar 58, 94p. 2 refs. Rept. no. 29.
Order from LC mi$5.40, ph$15.30 PB 137 771

Equations are developed for predicting the obstacle height and ditch width which a four-wheel vehicle may negotiate, based upon a vehicle with rigid wheels, operating on a hard surface of a known coefficient of friction. These equations are developed from purely static conditions. The equations were checked experimentally, using a small model in the laboratory. The experimental results correlated satisfactorily with the analysis.

Land Locomotion Research Branch, Ordnance Tank-Automotive Command, Center Line, Mich.
OPERATIONAL DEFINITIONS OF MECHANICAL MOBILITY OF MOTOR VEHICLES, by M. G. Bekker. June 58, 104p. 24 refs. Rept. no. 40.
Order from LC mi$5.70, ph$16.80 PB 137 900

Before broader concepts of Tactical Mobility are more satisfactorily defined, a definition of a narrower concept of Mechanical Mobility must be established within the realm of applied mechanics. This also is needed to guide the engineering progress in the development of more mobile vehicles, and in a physical evaluation of soil-vehicle systems. To this end it has been proposed to optimize mechanical performances of vehicles within the given spectra of terrain conditions by using operations research techniques. Such an optimized value of soil-vehicle system has been proposed as a definition of mechanical mobility within that system. The proposed procedure leads directly to the establishment of mathematical models of mobility within the given system, which in turn means that lengthy and costly proving ground techniques requiring prior development of full pledged vehicles may be substituted with much faster and cheaper computing techniques for mobility evaluation of vehicle concepts "in statu nascendi."

Purdue U. School of Industrial Engineering and Management, Lafayette, Ind.
TRANSPORTATION SYSTEMS RESEARCH II: CYCLIC SCHEDULING AND COMBINATIONAL TOPOLOGY; ASSIGNMENT AND ROUTING OF MOTIVE POWER TO MEET SCHEDULING AND MAINTENANCE REQUIREMENTS, by V. B. Gleaves (St. Louis-San Francisco Railway Co.) T. E. Bartlett, and A. Charnes. ONR Research memo. no. 10 on Contract Nonr-1100(05). Apr 57, 36p. 5 refs. AD-129 711.
Order from LC mi$3.00, ph$6.30 PB 136 279

MATERIALS

National Research Labs., Ottawa (Canada).
LAMINAR FLOW OF DILUTE FIBRE SUSPENSIONS, by W. D. Baines. 22 Aug 58, 18p. 7 refs. Rept. no. MH-73.
Order from LC mi$2.40, ph$3.30 PB 138 845

Flow of dilute fibre suspensions such as paper stock is considered on the basis of observed characteristics. It is assumed that there is a separation into two regions, one moving as a solid body and containing all of the fibre, and the other a thin film of liquid. Flow in pipes is considered in detail, particularly the consequences of this type of motion on the friction characteristics. Flow between rotating concentric cylinders is also considered, and it is shown how this type may be used to predict the friction properties of pipes.

Ceramics and Refractories

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
ZIRCONIA: ITS CRYSTALLOGRAPHIC POLYMORPHY AND HIGH TEMPERATURE POTENTIALS, by Berthold C. Weber and Murray A. Schwartz. Rept. on Surface and Interface Phenomena of Matter. July 58 [26]p. 21 refs. WADC Technical rept. 58-646; AD-206 908.
Order from OTS $0.75 PB 151 665

Zirconia (ZrO_2), with a melting point of 2680°C (4850°F) is one of the more promising materials for high temperature applications. Its usefulness is significantly dependent on controlling its crystallographic transformations. Experiments conducted in the Aeronautical Research Laboratory have clarified some of the controversial data presented in the literature. Future potentials for ZrO_2-base materials for high temperature structural and corrosion-resistance applications are described.

National Bureau of Standards, Washington, D. C.
MEASUREMENT OF THERMAL EXPANSION OF CERMET COMPONENTS OF HIGH TEMPERATURE X-RAY DIFFRACTION, by Floyd A. Mauer and Leonard H. Bolz. Rept. for 14 Feb 53-14 Sep 55 on Contract AF 33(616)53-12. Dec 55, 64p. 45 refs. WADC Technical rept. 55-473; AD-95 329.
Order from LC mi$3.90, ph$10.80 PB 136 066

The high-temperature specimen mount developed for use with a geiger counter diffractometer in measuring the thermal expansion of cermet components permits X-ray measurements to be made at temperatures up to 1400°C with an accuracy approaching that attainable at room temperature. Thermal expansion vs. temperature was measured on silver, tungsten, silicon, titanium carbide, niobium carbide, zirconium carbide, tantalum carbide, tungsten carbide, molybdenum disilicide, chromium silicide, magnesium oxide, rutile, thorium dioxide, stabilized zirconia, and indium antimony.

New Jersey Ceramic Research Station, Rutgers U., New Brunswick.
CERAMIC METALLOID-METAL BODIES. Rept. no. 19 (Annual rept. no. 1) 1 Oct 48-1 Oct 49, on Contract W33-038-ac-15800. Oct 49, declassified 8 May 50. 18p. AF Technical rept. no. 6051; ATI-67 901.
Order from LC mi$2.40, ph$3.30 PB 137 701

In Section I, a summary of progress in the development of ceramic-metalloid bodies, consisting of mixtures of MgO with TiC or TiN, is presented. Section II is a study of the variations in transverse strength of cermet bodies of the MgO-TiN-Ni series under varying conditions of composition, thermal shock, and high oxidizing temperatures. Tables I and II give some of the physical properties of the composition mentioned in Section II.

New Jersey Ceramic Research Station, Rutgers U., New Brunswick.
PROGRESS REPT NO. 5, DECEMBER 1, 1953-MARCH 1, 1954, by E. J. Smoke, A. V. Illyn and others. Rept. on Contract DA 36-039-sc-42577. Apr 54, 112p.
Order from LC mi$6.00, ph$18.30 PB 135 241

Contents:
Development of ceramic bodies with high thermal conductivity
High thermal shock ceramics
Ultra low loss ceramics
High impact resistant ceramics
Precision molded and machined radio ceramics
(See also PB 116 690, PB 116 691)

New York State Coll. of Ceramics, Alfred U.
METAL-CERAMIC LAMINATES, by R. K. Francis, R. Brown and others. Rept. for 1 Aug 56-31 July 57 and 1 Nov 57-31 Oct 58, on High Temperature and High Stress Characteristics of Ceramics and Cermets Contract AF 33(616)3798. Nov 58 [78]p. 46 refs. WADC Technical rept. 58-600; AD-205 549.
Order from OTS $2.00 PB 151 664

Forsterite-stainless steel 430, molybdenum-alumina, and Kovar-alumina laminates were fabricated employing brazing techniques. Laminates of molybdenum and a 40% alumina-60% mullite ceramic were hot pressed. Thermal expansion studies were made to facilitate the choice of laminate components. Crack free laminates were hot pressed from ceramic and metal materials of which the ceramic possessed the lower thermal expansion. In laminates having a ceramic material with a thermal expansion greater than the metal, cracking occurred. Thermal conconductivity studies were conducted on a forsterite-stainless steel 430 laminate series fabricated by brazing techniques. The measured conductivities of the laminates perpendicular to the laminae were seven to fourteen per cent lower than calculated results; the measured conductivities parallel to the laminae were five to fifteen per cent higher than the calculated results.

New York State Coll. of Ceramics, Alfred U.
METAL FIBER REINFORCED CERAMICS, by R. S. Truesdale, J. J. Swica, and J. R. Tinklepaugh. Rept. for 1 July 57 - 30 June 58 on Ceramic and Cermet Materials, Contract AF 33(616)5298. Dec 58, 45p. 10 refs. WADC Technical rept. 58-452; AD-207 079.
Order from OTS $1.25 PB 151 610

Techniques were developed for the sintering and hot pressing of alumina and alumina containing 5 wt. %, 10 wt.-% and 20 wt.-% molybdenum fibers. The physical and mechanical properties of alumina containing these percentages of 1/8 in. long by 0.002 in. dia. fibers were determined and compared to those of the alumina. The alumina was superior in strength and impact resistance but there was some indication that the aluminas containing 10 and 20 wt. % additions of fiber were superior in thermal shock resistance. All alumina samples containing 10 and 20% additions developed microcracks while only some 5% samples developed these cracks.

Fuels, Lubricants, and Hydraulic Fluids

Aberdeen Proving Ground, Md.
AN EVALUATION OF MIL-L-210 4A, OE-10 ENGINE OIL AS AN AUTOMATIC TRANSMISSION FLUID IN THE MODEL TX-200 TRANSMISSION, by D. E. Woomert. Rept. no. 18 on Ordnance Proj. no. TB5-1001. Sep 58, 23p. Engineering Labs. rept. no. 81.
Order from LC mi$2.70, ph$4.80 PB 138 164

Aberdeen Proving Ground, Md.
INVESTIGATION OF GUM CONTENT OF EXPERIMENTAL FUELS. SCREENING TESTS TO DETERMINE EFFECT OF MATERIALS AND COATINGS ON GASOLINE STABILITY AND GUM CONTENT, by C. B. Jordan and C. F. Pickett. 21 Apr 55, 16p. 8 refs. Proj. no. TB5-0010C-4, Rept. no. 7.
Order from LC mi$2.40, ph$3.30 PB 136 225

Five gallon samples of two fuels designated as "Camp Stoneman" and "European" fuels were forwarded to this installation from Southwest Research Institute. ASTM Gum values and oxidation stability curves were run on the fuels and blends of the two fuels. The nature of the gum was predicted by infra-red spectrophotometric analysis and verified by chemical analysis.

Army Rocket and Guided Missile Agency, Redstone Ala.
DETERMINATION OF TEMPERATURE GRADIENTS IN SOLID-PROPELLANT GRAINS BY USE OF SCALE MODELS, by Myron L. Cohen. 15 July 58, 71p. 10 refs. Rept. no. 3R5F.
Order from LC mi$4.50, ph$12.30 PB 137 278

The use of scale models in the determination of temperature gradients in solid-propellant grains depends upon the existence of a usable relationship between scaled versions of the same grain geometry. A relationship between corresponding points within any two bodies of similar cross section is presented. Three methods - numerical, electrical, and experimental - were used to determine the temperature distribution within each of three models having the same four-point-star grain geometry but differing in diameter.

National Bureau of Standards, Washington, D. C.
SPECIFIC GRAVITY OF ETHANOL-WATER AND METHANOL-WATER MIXTURES, by Charles T.

Collett. Rept. on Unconventional Fuel Handling and Servicing Equipment, Contract AF 33(616)55-12. 1 Dec 55, 59p. 4 refs. Rept. 4306; WADC Technical rept. 55-364; AD-110 429.
Order from LC mi$3.60, ph$9.30 PB 136 067

The densities of ethanol-water solutions and methanol-water solutions were determined by the picnometer method. Mixtures containing various percentages of alcohol from 22.5% to 100.0% were used, at temperatures from 20°F to 120°F. Tables and graphs of specific gravities were derived from the densities.

Ordnance Fuels and Lubricants Research Lab., Southwest Research Inst., San Antonio, Tex.
STUDY OF THE BASIC VOLATILITY CHARACTERISTICS OF GASOLINE: VAPOR-LOCKING TENDENCIES, TEST METHODS, by John N. Bowden. Rept. on Contract DA 23-072-ORD-1144. May 58, 86p. 42 refs.
Order from OTS $2.25 PB 151 176

The control of gasoline volatility in this country has been effected through the use of ASTM standardized tests in empirical relationships, which are only a relative indication of freedom from vapor lock. Although this approach has been relatively satisfactory in civilian application, there is a need for a more positive control of vapor-locking tendencies in military gasolines. Experimental data show that various volatility expressions and vapor pressure measurements do not rate the vapor-locking tendencies of military fuels consistently in the same order. Furthermore, in a few instances, calculated temperature-vapor/liquid ratio relationships do not agree with the experimentally determined values. Since the limiting vapor/liquid ratio of a vehicle fuel system is independent of ambient climatic conditions, the measurement of vapor/liquid ratios of gasolines at varying temperatures appears to be the most suitable criterion for volatility control. In order to establish practical vapor/liquid ratio limits, and to confirm the data presented herein, a road evaluation program utilizing military vehicles should be carried out and correlated with laboratory data.

Leather and Textiles

Industrial Test Lab., Philadelphia Naval Shipyard, Pa.
IDENTIFICATION OF NYLON 6 AND NYLON 66, by J. P. Ciaudelli. July 56, 10p. 1 ref. Development rept. no. 2928; AD-113 281.
Order from LC mi$1.80, ph$1.80 PB 137 544

Naval Research Lab., Washington, D. C.
AN IMPROVED DEVICE FOR THE FORMATION OF SUPERFINE, THERMOPLASTIC FIBERS, by K. D. Lawrence, R. T. Lucas, and J. A. Young. 11 Feb 59, 8p. 2 refs. NRL rept. 5265.
Order from OTS $0.50 PB 151 412

This report describes the modifications which have been made on the original NRL device for forming superfine, thermoplastic fibers. The modifications allow a more precise control of process variables. They include (a) a new nozzle which materially reduces shot formation, (b) an improved heating block and cooling system which reduces warmup time, and (c) an altered collection unit which markedly improves fiber laydown. The formation of reproducible lots of superfine, thermoplastic fibers of a given material is now possible.

Navy Clothing and Textile Office, Brooklyn, N. Y.
REPLACEMENT OF INDIGO DYESTUFFS FOR USE ON NAVY WOOLEN FABRICS. PART II. LABORATORY PHASE, by Gordon Bradley. June 58, 21p. 8 refs. Research and development rept. no. 27.
Order from LC mi$2.70, ph$4.80 PB 135 953

An evaluation was conducted of 16 ounce melton fabric laboratory dyed with experimental chrome dye formulations. Particular emphasis was placed on a visual evaluation of the experimental shades in comparison with the standard indigo-chrome shade. Spectrophotometric methods of analysis were investigated. Conclusions and recommendations were made.

Quartermaster Research and Engineering Center, Natick, Mass.
BLENDS OF WOOL-TYPE FABRICS, by H. Bogaty and N.R.S. Hollies (Harris Research Labs.) and C. J. Monego. Aug 58, 87p. 45 refs. Textile Series rept. no. 98.
Order from LC mi$4.80, ph$13.80 PB 136 730

As a wool conservation measure, the use of synthetic fibers to replace wool in 16- and -8-oz cold weather combat clothing fabrics has been explored. Such commercially-available synthetic fibers as ACRILAN, DACRON, dynel, nylon, ORLON, VICARA, and viscose have been considered in two- and three-fiber blends. The results indicate that, insofar as insulation is concerned, the substitution of short, crimped synthetic fibers in a low-twist yarn, and of an open-textured weave appropriately fulled, maintains the desirable insulating qualities of all-wool. With respect to flame and thermal protection, the chemical composition of the synthetic fibers appear most important, but the data show that fabric structure also influences the degree of protection. There is no great difference in appearance between the synthetic blended fabrics and all-wool. The durability of the blended fabrics was found to be equal to or, in the case of high strength fibers, significantly greater than, all-wool. Production of these blends proved feasible and offered no problems.

Paints and Finishes

Bjorksten Research Labs., Inc., Madison, Wis.
TRANSPARENT PLASTIC SHEET MATERIALS FOR AIRCRAFT GLAZING. Final rept. on Contract NOas-

52-656-c. Apr 53, 66p.
Order from LC mi$3.90, ph$10.80 PB 137 078

The research program described in this report was conducted to develop one or more transparent plastic sheet materials for aircraft glazing. The developed materials were to be integrally uniform but with hardened outer sides and a softer inner core. In addition, these materials should be suitable for the production of aircraft canopies. Basically these materials were produced by the surface treatments of heat-resistant acrylic plastic sheet described in Sections I and II. Promising treatments were screened by evaluating the abrasion, or mar resistance, craze resistance, and scratch resistance of treated acrylic. The efficacy of the various treatments in improving the surface characteristics is discussed in Sections I and II.

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
DEVELOPMENT OF A FUMING NITRIC ACID RESISTANT PAINT, by Melvin H. Sandler. Rept. no. 2. 24 Sep 58, 13p. 3 refs. Rept. no. CCL #64.
Order from LC mi$2.40, ph$3.30 PB 136 731

This investigation covers the development of an acid resistant paint to provide protection for tankage and equipment used in the handling of Inhibited Red fuming Nitric Acid. A satisfactory paint based on a synthetic elastomer, chlorosulfonated polyethylene, was prepared and found to have excellent resistance to the acid.

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
RAPID AND ACCURATE DETERMINATION OF NONVOLATILE CONTENT OF HEAT-STABLE AND HEAT-REACTIVE RESINS AND PIGMENTED ENAMELS, by M. H. Swann. 20 Feb 58, 8p. Rept. no. CCL #50.
Order from LC mi$1.80, ph$1.80 PB 138 426

An attempt was made to duplicate the accuracy of the ASTM "foil" method for nonvolatile determinations (Method D1259-56T) using pans to eliminate its many inconveniences. The "foil" method is the only accurate method available but is not adaptable to routine analysis of a large number of paint samples. The preparation of the foil, the extra weighings, and non-adaptability to samples of extremely high or low viscosity are undesirable features. Through the use of special aluminum pans that are commercially available, the use of small, carefully weighed samples, and the routine dilution of all samples with solvent, a method has been developed that has accuracy equal to the "foil" method with none of its disadvantages.

Metals Processing Lab., Inst. of Tech., Cambridge.
GROWTH OF CHROMIUM COATINGS FROM LIQUID METALLIC SOLUTIONS, by Stanley T. Wlodek and John Wulff. Technical rept. on Contract Nonr-1841(30). Oct 57, 81p. 29 refs.
Order from OTS $2.25 PB 151 126

Some investigations of the oxidation resistance and adherence of the coating were performed. Theoretical aspects of the nucleation, growth, and morphology of the coating were analyzed. Determinations of the solubility of solid molybdenum in liquid copper and tin, and solid chromium in liquid tin were performed using a simplified weight loss method.

Naval Research Lab., Washington, D. C.
THE DEGRADATION OF POLYMERS BY ULTRAVIOLET IRRADIATION; PART I - WHEN SUBJECTED TO RADIATION OF THE "NEAR" ULTRAVIOLET REGION IN AIR, by A. L. Alexander, F. M. Noonan, and others. 6 Feb 59, 12p. 2 refs. NRL rept. 5257.
Order from OTS $0.50 PB 151 411

One phase of a research program to develop suitable coatings for space vehicles is concerned with studying the effects of ultraviolet radiation on typical polymeric coatings in air. These coatings may be used to control the absorption and emission of radiant energy by the underlying bodies, and to be effective the coatings must be physically and chemically stable to the high-altitude environments in which they should serve. The initial study under this general program required irradiating a number of typical polymeric coatings with a near-ultraviolet source at ambient conditions for about 300 hours. Infrared absorption data were collected on the film samples before, during, and after this exposure to determine the degradation brought about by the radiation. It was observed that the relative stability of the polymeric materials which were irradiated roughly parallels their relative order of stability to gamma radiation. The infrared data indicate the relative stability, in decreasing order, to be as follows: polystyrene, melamine formaldehyde, urea formaldehyde, styrenated alkyd, soya oil alkyd, silicones, and polyvinyl chloride. These initial experiments, qualitative and largely exploratory in nature, indicated that infrared spectroscopy affords a satisfactory means of qualitatively following the chemical changes induced by the ultraviolet. Beyond these findings, however, is the need to produce quantitative and more significant, high-altitude-type, far-ultraviolet data. Methods for carrying out this phase of the study are now under examination and equipment is being assembled.

Photographic Materials

Institute of Mathematical Sciences, New York U.
APPLICATION OF INORGANIC PHOSPHORS TO INFRARED PHOTOGRAPHY, by H. Kallmann and J. Rennert. Technical rept. on Contract Nonr-285(25). 28 Oct 57, 9p. 4 refs.
Order from OTS $0.50 PB 151 179

The utilization of zinc cadmium sulfide phosphor plates to record infrared radiation is described. Radiation of wavelengths as long as 2.5 microns was depicted for subsequent visual observation or permanent record. The sensitization consists of populating traps by uniform excitation of the entire phosphor plate. The infrared radiation to be depicted decreases

the trap population of the phosphor corresponding to the intensity distribution of the incident beam resulting in a latent image. The latter is then developed (made visible) by exciting the entire phosphor plate which results in a visible, transient negative fluorescence image. With phosphors which exhibit any degree of visible stimulated luminescence on irradiation with shortwave ($\simeq 0.7\mu$) infrared the latent image can also be developed by flooding the entire phosphor with near infrared. Sensitization, exposure and development can be effected in rapid succession or after large time intervals (weeks) between steps.

Kansas State Coll., Manhattan.
STUDIES ON NEW PHOTOGRAPHIC PROCESSES, by Jack L. Lambert. Rept. on Contract AF 33(616)430. May 57, 37p. 11 refs. WADC Technical rept. 57-149; AD-118 119.
Order from LC mi$3.00, ph$6.30 PB 136 179

A summary of the work carried out under this Contract is presented, together with a theoretical discussion of the photochemical processes involved. Complexes of tripositive manganese, iron, and cobalt formed from organic ligands were found to be sufficiently photosensitive for photographic purposes.

Plastics

Aberdeen Proving Ground, Md.
PLASTIC MATERIAL TARPAULINS, by O. C. Lamb. Rept. no. 54 on Ordnance Proj. no. TT1-649. Oct 57, 8p.
Order from LC mi$1.80, ph$1.80 PB 137 543

Tarpaulins fabricated of plastic materials were tested to evaluate their suitability for military trucks. Two tarpaulins, of different designs, were installed on M211 trucks. The covers were subjected to a user-type test for a period of approximately 10 months, during which they were exposed to varying weather conditions. The plastic material was more susceptible to puncture than canvas. The over-all maintenance characteristics, however, are more desirable, and it is recommended that tarpaulins of the material tested be considered acceptable, with respect to endurance qualities, for use on military trucks.

Army Chemical Warfare Labs., Army Chemical Center, Md.
THIRD MATERIALS REVIEW (1 JULY - 31 DECEMBER 1957) by Arthur Lyem. May 58, 51p. 43 refs. CWL Special Pub. 4-3.
Order from LC mi$3.60, ph$9.30 PB 137 665

The purpose of this periodic review is to present information of important technical and scientific high lights regarding materials research here and abroad, principally in the polymer and plastics field.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
EFFECT OF TESTING RATE AND TYPE OF MACHINE ON TENSILE PROPERTIES DATA FOR PLASTICS, by Elise McAbee. Nov 58, 22p. 3 refs. Technical rept. no. 2569; AD-202 004.
Order from LC mi$2.70, ph$4.80 PB 138 406

Representative plastic materials were tested in tension using (a) various rates of straining, (b) two methods of rate of strain control, and (c) two different testing machines. For the materials tested, no consistent relationships were found among the results obtained by the various testing methods. Adherence to the standard specification for testing (ASTM-D 638) will produce erratic results, indicating that the test sample conditioning requirements are too liberal for accurate duplication of results.

Notre Dame U., Ind.
FINAL REPORT, CONTRACT Nonr-1623(02). July 57, 7p.
Order from LC mi$1.80, ph$1.80 PB 135 442

Studies were made of the attenuation of ultrasonic waves in butanes and pentanes. Dielectric studies were also made on four acrylics. Volume dilation of rubber during isothermal extension was also covered.

Pennsylvania State U., University Park.
CREEP-TIME RELATIONS FOR POLYSTYRENE UNDER TENSION, BENDING, AND TORSION, by Joseph Marin. Technical rept. no. 1 on Contract N6onr-269(06). Aug 48, 31p. 5 refs.
Order from LC mi$3.00, ph$6.30 PB 139 532

In this investigation, creep-time relations for polystyrene specimens subjected to tension, bending and torsion were obtained. The influence of the magnitude of the stress and time upon the creep deformations was determined for each of the foregoing types of stress. In all tests the relative humidity was maintained at 50% ± 2% and the temperature at 77° F ±2° F. A number of methods of interpretation of the tension-creep test results were applied for the purpose of obtaining suitable stress-creep-time empirical relation. A log-log relation between the creep rate and the stress was found to approximately represent the data for the three types of stresses considered. Theoretical values of the creep rates for bending and torsion, based on the tension log-creep rate-log stress relation, agreed approximately with the actual creep rates obtained in the bending and torsion tests.

Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.
STANDARDIZATION STUDY OF LONG-TERM STORAGE PROCESSES. I. STRIPPABLE FILM CONTAINER, by W. J. Shields and W. F. McTeague. July 57 [22]p. 25 refs. Rept. R-1397; AD-139 593.
Order from OTS $0.75. PB 151 295

The standardization of long-term storage processes throughout the military services is desired by the

Department of Defense. Available data and reports pertaining to the use of strippable, sprayable plastic containers for preserving materiel in long-term storage are reviewed and analyzed. The development of strippable, sprayable film coating systems for long-term controlled humidity storage is traced historically. The nonadhering and adhering film barrier materials are compared. Application methods, together with acceptable modifications, are given for the fabrication of unsupported systems or supported one-, two-, and three-coat container systems prepared from sprayable compounds. Comparison of the properties of adherent and nonadherent films is made. Costs for fabrication of a three-coat strippable plastic container system are presented. Durability of the single-coat container is compared with the two-and three-coat system. The use of volatile corrosion inhibitors for maintaining preservative conditions inside these plastic containers is not recommended. Recommendations are made for the standardization of strippable plastic containers in long-term, interim and short-term storage

Plastics Lab., Princeton U., N. J.
HYDROSTATIC PRESSURE EFFECT ON POLYMER MELT VISCOSITY, by Bryce Maxwell and Alex Jung. Technical rept. no. 46A on Contract DA 36-039-sc-70154. 1 July 1957, 25p.
Order from OTS $0.75 PB 151 232

Plastics Lab., Princeton U., N. J.
MECHANICAL SPECTROMETRY STUDIES OF POLYVINYL CHLORIDE, by Bryce Maxwell. Rept. on Contracts DA 36-039-sc-70154, no. 7c, and NAonr-37-48, 15 Aug 57, 42p. 5 refs.
Order from OTS $1.25 PB 151 233

The dynamic mechanical properties of pure polyvinyl chloride and plasticized polyvinyl chloride have been determined using a new type of mechanical spectrometer. Studies were made of the variation of the real modulus, imaginary modulus and mechanical loss factor as a function of both frequency and temperature in the glassy state, through the transition region and in the rubbery state. The changes in dynamic properties resulting from both internal and external plasticizing have been investigated to demonstrate the usefullness of this technique as a rapid method of characterizing plasticizer effectiveness.

Rubber and Elastomers

Material Lab., New York Naval Shipyard, Brooklyn.
DEVELOPMENT OF A SANDBLAST APPARATUS AND PROCEDURE FOR USE IN DETERMINING THE SERVICEABILITY OF ELASTOMERIC COATINGS FOR PROTECTION OF METAL MEMBERS OF NAVAL VESSELS AGAINST EROSION, by J. Z. Lichtman. Final rept. 21 Aug 56, 24p. 23 refs. Lab. project 4759-14, pt. 5.
Order from LC mi$2.70, ph$4.80 PB 137 010

Using five representative coating materials sand delivery and abrasion characteristics of the apparatus were investigated at operating air pressures up to 83 psi. An abrasion calibration procedure using aluminum panels was also developed for purposes of standardization.

Material Lab., New York Naval Shipyard, Brooklyn.
EVALUATION OF BUTYL-SILICONE BLENDS FOR USEFULNESS AT HIGH AND LOW TEMPERATURES AND RESISTANCE TO WATER AND LUBRICATING OIL, by N. B. Levine. Final rept. on Lab. project 5400-5. 27 May 58, 12p.
Order from LC mi$2.40, ph$3.30 PB 136 385

A series of butyl-150 blends containing vinyl silicone (Dow 410 gum) in the ratio of 0% to 30% by weight vinyl silicone to total polymer was prepared using the formulation which was found to be most promising from the standpoint of stress-strain results. The vulcanized blends, both gum and filled stocks, were then tested to determine: (a) resistance to change in tensile properties after oven aging and after immersion in water and ASTM #3 oil at various temperatures, and (b) high and low temperature compression set. The results indicate that vinyl silicone may be most useful in a blend with butyl-150 as a means of improving the high and low temperature compression set properties of filled vulcanizates. Vinyl silicone may also be useful in improving the resistance of the butyl polymer to various lubricating oils.

[Material Lab.] New York Naval Shipyard, Brooklyn.
RUBBER HOSE, DIAPHRAGMS AND GASKETS RESISTANT TO SPECIAL FUELS; REPORT OF DEVELOPMENT AND STANDARDIZATION OF SCREENING TESTS FOR EVALUATION OF. Final rept. 10 July 58, 7p. 6 refs. Lab. Project 5998-2.
Order from LC mi$1.80, ph$1.80 PB 137 427

Rubber Lab., Mare Island Naval Shipyard, Vallejo, Calif.
DEVELOPMENT OF IMPROVED GASOLINE HOSE TUBE STOCK LOW IN EXTRACTABLE GUM FOR LOW-TEMPERATURE SERVICE. 16 Sep 57, 9p. 8 refs. Rept. no. 27-16.
Order from LC mi$1.80, ph$1.80 PB 137 541

The Rubber Laboratory had previously developed a stock, 128-40, for gasoline hose tube, which met the requirements of Military Specification MIL-H-370A for Class 2 materials. This stock was low in extractable gum and stoved gum, and was fairly flexible at -42°F. Information subsequently obtained indicated, however, that this stock might be too scorchy for factory processing. The Laboratory has now developed another stock, 128-44, for the same purpose. This stock is appreciably less scorchy than stock 128-40, but is similar to it in respect to other properties. Stock 128-44 also meets all of the requirements of Specification MIL-H-370A for Class 2 materials.

Rubber Lab., Mare Island Naval Shipyard, Vallejo, Calif.
RESULTS OF ACCELERATED CORROSION TESTS ON SIMULATED PROPELLER SHAFTS PROTECTED BY VARIOUS RUBBER COATINGS. 3 Aug 56, 25p. 2 refs. Rept. no. 25-18.
Order from LC mi$2.70, ph$4.80 PB 137 677

MATHEMATICS

Applied Mathematics and Statistics Lab., Stanford U., Calif.
TWO-SIDED TOLERANCE LIMITS FOR NORMAL DISTRIBUTIONS USING THE RANGE, by George J. Resnikoff. Technical rept. no. 33 on Contract N6onr-251(26). Apr 57, 21p. 16 refs. AD-129 264.
Order from LC mi$2.70, ph$4.80 PB 135 199

A table of two-sided tolerance limits for a normal universe utilizing the sample range or sample average-range is given. The table was constructed by a straight forward adaptation of an approximation to tolerance limits using the sample standard deviation, due to Wald and Wolfowitz. (Annals of Mathematical Statistics 12:91-96, 1941).

California U., Berkeley.
FORMULA FOR THE MULTIPLICITY OF A WEIGHT, by Bertram Kostant. Technical rept. no. 4 on Contract AF 49(638)79. Apr 58, 45p. 8 refs. AFOSR TN-58-315; AD-154 219.
Order from LC mi$3.30, ph$7.80 PB 135 976

California U., Berkeley.
ON THE ANALYTICITY OF THE SOLUTIONS OF ANALYTIC NON-LINEAR ELLIPTIC SYSTEMS OF PARTIAL DIFFERENTIAL EQUATIONS. PART II. ANALYTICITY AT THE BOUNDARY, by Charles B. Morrey, Jr. Technical rept. no. 13 on Contract Nonr-222(37). Aug 57, 35p. 4 refs.
Order from LC mi$3.00, ph$6.30 PB 136 437

California U., Berkeley.
ON THE PROPERTIES OF THE COEFFICIENTS OF LINEAR ELLIPTIC SYSTEMS DETERMINED FROM THE PROPERTIES OF THE SOLUTIONS, by Avner Friedman. Technical rept. no. 14 on Contract Nonr-222(37). Aug 57, 17p. 7 refs.
Order from LC mi$2.40, ph$3.30 PB 136 436

California U., Berkeley.
ON THE STRUCTURE OF CERTAIN MEASURES, by Errett Bishop. Technical rept. no. 11 on Contract Nonr-222(37). Aug 57, 14p. 5 refs.
Order from LC mi$2.40, ph$3.30 PB 136 438

Carnegie Inst. of Tech., Pittsburgh, Pa.
A FUNCTION-THEORETIC SOLUTION OF CERTAIN INTEGRAL EQUATIONS II, by Albert E. Heins and Richard C. MacCamy. Technical rept. no. 22 on Contract AF 49(638)227. Apr 58, 22p. 9 refs. AFOSR TN-58-250; AD-154 153.
Order from LC mi$2.70, ph$4.80 PB 135 991

This report continues the study of solution of integral equations by translation into functional relations for multiple-valued analytic functions on a Riemann surface. Two homogeneous equations of second kind are solved, one with a difference kernel having a logarithmic singularity and the other with a sum kernal. Extensive use is made ot the Laplace transform of an analytic function.

Carnegie Inst. of Tech., Pittsburgh, Pa.
OSCILLATION CRITERIA FOR FOURTH-ORDER LINEAR DIFFERENTIAL EQUATIONS, by Henry Howard. Technical rept. no. 21 on Contract AF 49(638)227. June 58, 43p. 5 refs. AFOSR TN-58-421; AD-158 224.
Order from LC mi$3.30, ph$7.80 PB 135 364

The problem of obtaining oscillation criteria for self-adjoint linear differential equations of second and fourth order has recently been studied from the point of view of an eigen-value problem closely related to the differential equation under consideration [4], [5]. A variety of conditions for oscillation or non-oscillation of such equations may be obtained by use of this technique.

Cornell U., Ithaca, N. Y.
FINITE CONVOLUTION TRANSFORM, by Jerome Blackman and Harry Pollard. Rept. no. 65 on Contract AF 18(600)685. Aug 57, 15p. 2 refs. AFOSR TN-57-452; AD-136 442.
Order from LC mi$2.40, ph$3.30 PB 135 988

A complete solution is found of the integral equation

$$f(x) = \int_0^x \varphi(s-t)dk(t), \quad 0 \leq x < a$$

where f and k are given and φ is to be determined. The method consists in convolutions of infinite order.

Cornell U., Ithaca, N. Y.
ON THE REGULARITY OF THE GROWTH OF MEROMORPHIC FUNCTIONS WITH HIGHLY DEFICIENT ZEROS AND POLES, by A. Edrei and W. H. J. Fuchs. Rept. no. 59 on Contract AF 18(600)685. Nov 56, 17p. 3 refs. AFOSR TN-56-515; AD-110 330.
Order from LC mi$2.40, ph$3.30 PB 136 420

The authors consider a meromorphic function f (z) and show that if its zeros and poles are highly deficient, the lower order of f (z) is close to its order. In particular, if $\delta(0)+\delta(\infty)=2$, the increase of f(z) is regular, that is the order and lower order coincide. [For functions of infinite order this is to be interpreted as meaning that the lower order is infinite].

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
ON LINEAR, HYPERBOLIC EQUATIONS OF SECOND ORDER, by A. Douglis. Rept. on Contract AF 18(600)573. June 58, 27p. 8 refs. Technical note BN-139; AFOSR TN-58-558; AD-158 376.
Order from LC mi$2.70, ph$4.80 PB 135 575

In this paper, we present a new means of reducing to an integral equation the problem of Cauchy for a linear, hyperbolic, partial differential equation of second order with variable, not necessarily analytic, coefficients.

Institute of Statistics, North Carolina State Coll., Raleigh.
ANALYSIS OF COVARIANCE: A REVIEW, by H. F. Smith. Technical rept. no. 13 on Experimental Design for Industrial Research, Contract DA 36-034-ORD-1517. Sep 56, 86p. 73 refs.
Order from LC mi$4.80, ph$13.80 PB 139 359

Statistical analysis with several variates or variables has become loosely classified into multivariate analysis, regression analysis and analysis of covariance. Most workers have more or less definite ideas about what is implied by each term, but few would agree with any specific definition of their boundaries. Most multivariate work is in one sense or another covariance analysis; but, from its introduction by Fisher (1934) as an adjunct to analysis of variance, the term "analysis of covariance" has had a special connotation, although the restriction may not always be maintained. This review attempts to put the typical analysis of covariance into focus with general regression analysis of which it is a part.

Institute of Statistics, North Carolina State Coll., Raleigh.
EXPLORATION AND EXPLOITATION OF RESPONSE SURFACES, by G. E. P. Box. Technical rept. no. 4 on Experimental Designs for Industrial Research, Contract DA 36-034-ORD-1177. [1953] 53p. 5 refs.
Order from LC mi$3.60, ph$9.30 PB 133 405

Some three years ago Dr. K. B. Wilson and the author of this report read a paper before the Royal Statistical Society concerning the experimental attainment of optimum conditions. The methods there discussed grew out of experience acquired in a number of chemical investigations. Since that time many such investigations have been conducted along the general lines suggested. The object of the present report is to illustrate and discuss certain ideas which arise from this work and which it is believed may be of value in a wider field than that to which they have so far been applied.

Kansas U., Lawrence.
SUBMANIFOLDS OF DIMENSION n - 1 IN $\mathcal{C}^n$ WITH NORMALS SATISFYING A LIPSCHITZ CONDITION, by Kenneth R. Lucas. Technical rept. 18 on Studies in Eigenvalue Problems, Contract Nonr-583(04). May 57, 57p. 6 refs. AD-131 797.
Order from LC mi$3.60, ph$9.30 PB 135 971

A study is made of the geometric structure of surfaces of class $C^{1,1}$, whose boundaries have normals which satisfy a Lipschitz condition. Detailed proofs are given of theorems characterizing, by intrinsic geometrical properties, the closed subsets of the n-dimensional Euclidean space E^n which are in fact (n-1)-dimensional submanifolds of class C^1. Developments are made which show that a $C^{1,1}$ surface is contained locally between 2 spheres tangent to it, one internal and one external, each with radius r_0, which is called the minimal radius of the surface S. Properties of certain circles are obtained when S is $C^{1,1}$. The main theorem states that $C^{1,1}$ surfaces with minimal radii $\geq r$ can be characterized by the fact that their interior and exterior domains are unions of spheres of radius r. Surfaces which are parallel to S, at a distance less than r from S are also discussed. The class $C^{1,1}_r$ of all $C^{1,1}$ surfaces with minimal radius $\leq r$ is treated as a subspace of the space of all bounded closed subsets of E^n provided with the Hausdorff metric h. In the relations discussed between surfaces lying at a Hausdorff distance less than r apart, an assertion is made that in case this distance is $\leq r(2-\sqrt{2})$, the projection of one on the other is a homeomorphism. Counterexamples are produced to demonstrate the impossibility of improvement on some of the given developments.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOME PROPERTIES OF STATIONARY GAUSSIAN PROCESSES, by E. J. Kelly and I. S. Reed. Technical rept. no. 157 on Contract AF 19(122)-458. 4 June 57, 21p. 1 ref. AD-150 864.
Order from LC mi$2.70, ph$4.80 PB 139 208

In this report the methods of the theory of stochastic processes, particularly the spectral-representation theory, are applied to the definitions and study of Gaussian processes representing signals in noise. Many standard results and some new ones are derived by these methods.

Minnesota U., Minneapolis.
ON THE MEASURE OF HILBERT NEIGHBORHOODS FOR PROCESSES WITH STATIONARY, INDEPENDENT INCREMENTS, by Glen Baxter. Technical rept. no. 6 on Contract AF 18(603)30. 1 Jan 58, 10p. 2 refs. AFOSR TN-58-159; AD-152 185.
Order from LC mi$1.80, ph$1.80 PB 138 862

The double Laplace transform of the measure of the Hilbert neighborhood of the origin for processes with stationary, independent increments is shown to be the solution of a certain differential equation. The proof is based on work by Kac. Examples are given, including an evaluation for the measure of the Hilbert neighborhood of the origin for the Poisson process.

Stanford U., Calif.
ASYMPTOTIC NORMALITY AND EFFICIENCY OF CERTAIN NONPARAMETRIC TEST STATISTICS, by Herman Chernoff and L. Richard Savage. Technical rept. no. 15 on Contract Nonr-225(21). 13 Sep 57, 37p. 9 refs.
Order from LC mi$3.00, ph$6.30 PB 136 435

Computing Devices

Air Force Cambridge Research Center, Bedford, Mass.
A NEW METHOD OF CUBE ROOT EXTRACTION ON DESK CALCULATORS, by George E. Reynolds. Apr 58, 30p. 4 refs. AFCRC TR-58-133; AD-133 760.
Order from LC mi$2.70, ph$4.80 PB 138 423

A simple method for extracting cube roots on desk calculators with the aid of a brief table is given. Tables for accuracies of five, six, and seven places are included. Roots to nearly double the accuracy can be obtained from the calculated roots.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
AUTOMATIC DATA PROCESSING SYSTEMS OPERATING PRINCIPLES AND COMPUTER PROGRAMMING, by Viola Woodward, ed. Aug 58, 177p. 6 refs. Memo. rept. no. 1158.
Order from LC mi$8.10, ph$27.30 PB 136 571

This report contains the course notes written for the Automatic Data Processing Systems Operating Principles and Computer Programming Course being taught for Ordnance personnel by the Computing Laboratory of the Ballistic Research Laboratories. The objective of the course is to equip the student to define problems; to teach him the fundamentals of electronic data processing machines and what can be expected of their employment; to give the student a basis for intelligent evaluation of data processing situations in his own establishment for mechanization by automatic equipment; and to teach him basic operating principles and computer programming. Emphasis is placed on the principles of operation of self-governed (programmed) data processing machines, since a sound understanding of these machines and their capabilities (gained from attempting to use them) is essential to plan intelligently for their use in the solution of data processing problems.

Cook Electric Co., Skokie, Ill.
BATHYTHERMOGRAPH DATA ANALYZER, A. D. Anderson, Robert F. Bosshart and others. Final progress rept. FPR 129-1, 1 Apr-31 Oct 55, on Contract Nonr-1601(00). 11Apr 57, 117p. AD-134 664.
Order from LC mi$6.00, ph$18.30 PB 136 209

A group of 1325 Bathythermograph (BT) slides were processed by using the Bathythermograph data analyzer (BTDA). Mechanical and electrical development on the BTDA was completed. A variable speed scan was designed for the BT, and a playback amplifier was installed with the 599-line tabular screen to handle a wider range of film densities. A system was provided for automatic 2-speed operation of the playback scanner. More accurate reading of the temperature reading mechanism was achieved by a less flexible linkage. A reversal of the 599-line screen was made to correct the light pulse which was blurring the last counts on film. Thirteen major operations of the BTDA were performed by means of a problem involving a large number of slides. Six different operational setups were performed on each major operation. Temperatures at preset depths of 50, 100, 200, and 400 ft and the depth of preset temperatures of 64°, 65°, and 66° F were found on scanned BT slides. The temperature and depth at the beginning and end of each thermocline were recorded.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
DIGITAL-ANALOG FUNCTION GENERATORS, by R. W. Hofheimer and K. E. Perry. Technical rept. no. 162 on Contract AF 19(122)458. 23 Aug 57, 12p.
Order from LC mi$2.40, ph$3.30 PB 139 210

Digital-analog function generators are similar in application to digital-to-analog converters except that their outputs, instead of being proportional to the inputs, are proportional to functions of the inputs. If, for example, the input to a digital-analog function generator is x in digital form, then the output can be an analog voltage proportional to sin x or log x or any of a wide variety of functions of x. Functions of more than one input variable can also be handled.

MECHANICS

Equipment Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
EXPERIMENTS IN RANDOM VIBRATION, by V. C. McIntosh and Neal Granick. June 56, 17p. WADC Technical note 56-228; AD-97 121.
Order from LC mi$2.40, ph$3.30 PB 137 765

Small simple beams are subjected to both sine wave and white-noise random vibration and tested to failure. The vibration levels required to produce failure with white-noise random vibration are compared to those required with resonance testing. Also, experiments are conducted to determine the effects of resonant and dead mass loads on the response of vibrators in conducting white-noise random vibration tests.

Michigan U. Research Inst., Ann Arbor.
ON AXIALLY SYMMETRICAL PLATES OF VARIABLE THICKNESS, by F. Essenburg. Technical note no. 2 on Contract AF 18(603)47. July 58, 7p. 8 refs. UMRI 2500-2-T; AFOSR TN-58-174; AD-152 205.
Order from LC mi$1.80, ph$1.80 PB 136 997

Aerodynamics and Pneumatics

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
ON THE PROBLEMS OF RE-ENTRY INTO THE EARTH'S ATMOSPHERE, by Alfred C. Robinson and

Algimantas J. Besonis. Rept. for 23 Jan 58-28 May 58 on Man in Space. Aug 58 [68]p. 19 refs. WADC Technical rept. 58-408; AD-203 790.
Order from OTS $1.75 PB 151 662

Re-entry into the earth's atmosphere has been studied from the standpoints of deceleration, heating, and accuracy of impact. This has been done for re-entry speeds consistent with return from near satellite orbits, and for speeds consistent with re-entry from a circumlunar orbit under several configurations of lift and constant or variable drag coefficient assumptions. Heating considerations are based only on stagnation point influences. It is shown that deceleration and peak heating rates are not larger than those occuring in ballistic missile re-entries. The total heat input, however, is much larger as the heating occupies a much longer time. It appears that simple, non-lifting re-entry will be feasible from satellite orbits. The lunar re-entry, on the other hand, presents a severe total heat problem and accuracy requirements are such that some lift or other control will probably be required.

[Army Rocket and Guided Missile Agency, Redstone,] Ala.
THE REDSTONE ARSENAL 7" X 7" SUPERSONIC WIND TUNNEL, by Oscar C. Holderer. 1 July 55, 35p. Rept. no. 1R7.
Order from LC mi$3.00, ph$6.30 PB 137 669

This report presents the mechanical and operational features of the Redstone 7"x 7" supersonic wind tunnel. It is published to furnish basic information for the design of wind tunnel models for use in this tunnel; to serve as a maintenance and repair guide and operational manual; and to disseminate pertinent data to others engaged in wind tunnel design and operation.

Arnold Engineering Development Center, Tullahoma, Tenn.
THE UNIT REYNOLDS NUMBER AS A PARAMETER IN BOUNDARY LAYER STABILITY, by Jack D. Whitfield and J. Leith Potter. Rept. on ARO, Inc. Contract AF 40(600)-700 S/A 13(59-1). Oct 58, 10p. 18 refs. AEDC TN-58-77; AD-202 731.
Order from LC mi$1.80, ph$1.80 PB 136 565

A possible basis for the general, experimentally demonstrated, upward trend of Reynolds number of transition with increasing free-stream unit Reynolds number is sought in stability theory. In order to eliminate effects caused by leading edge shock waves, the analysis considers subsonic flow. The only variables allowed are the unit Reynolds number and accompanying changes in frequency and energy of fluctuations which are believed to be affected by the unit Reynolds number. On the basis of the qualitative analysis presented, it is shown that boundary layer transition data may be expected to show the trend usually found, even without the existence of roughness or leading edge effects.

Brown U., Providence, R. I.
SURVEY OF INFORMATION ON RECENT TURBOMACHINERY CASCADE INVESTIGATIONS, by Max J. Schilhansl. Rept. on Gas Turbine Technology, Contract AF 33(616)2984. Mar 58, 151p. 56 refs. WADC Technical rept. 57-745; AD-142 223.
Order from OTS $2.75 PB 151 591

This survey is a continuation of the turbomachinery cascade literature survey published in 1955 as WADC TR 54-322 (PB 123 984). Survey areas are, as previously, investigations on non-viscous incompressible, viscous, and compressible cascade flow. Three-dimensional flow effects in cascades have been added as a new area. This state of completeness in basic cascade theory made it possible during the last years to extend the cascade research in several directions, namely to study viscosity effects, compressibility effects, and three-dimensional flow. The problem of compressibility effects or of transonic flow past cascades is still far from being solved in a strict sense in spite of many good contributions. Compressible flow can be derived from incompressible flow simply by distorting the cascade geometry in the direction perpendicular to the mean velocity by a factor $1/\sqrt{1 - M^2}$, but only up to M 0.5 or 0.6 with sufficient reliability. A final judgment of other theoretical attempts seems to be possible as soon as enough numerically evaluated information on Mach number effects is available. The Mach number at which the first shock occurs in the flow apparently restricts the validity of results to subsonic flow. For strictly transonic flow, one must rely upon experimental research. The problem of simulating exactly two-dimensional flow in a test setup is, in this case, much more difficult than it is at low Mach number or in incompressible flow. A very valuable contribution to cascade experiments at conditions at which cavitation is impending or already occuring may be attributed to F. Numachi and his associates.

David Taylor Model Basin, Washington, D. C.
PRELIMINARY INVESTIGATION OF A JET-FLAP WING CONFIGURATION, by H. R. Chaplin. Apr 56, declassified 1 July 57, 37p. 8 refs. Aero rept. 896.
Order from LC mi$3.00, ph$6.30 PB 135 328

The results of two-dimensional wind-tunnel test on an airfoil employing high-momentum blowing over a short flap are presented. The configuration was found to be highly effective as a lift producer. Lift coefficients greater than 5 with a blowing momentum coefficient of 0.5, and greater than 7 with a momentum coefficient of 1.0 were measured at zero angle of attack. The effect of the size of the physical flap is discussed briefly. Rough estimates of some low-speed characteristics of jet-flap aircraft are developed in an Appendix to the report.

Douglas Aircraft Co., Inc., El Segundo, Calif.
SMALLEST HEIGHT OF ROUGHNESS CAPABLE OF AFFECTING BOUNDARY-LAYER TRANSITION IN LOW-SPEED FLOW, by A. M. O. Smith and D. W. Clutter. Rept. on Contract NOa(s)54-773c. 31 Aug 57, 117p. 30 refs. Aerodynamic Research rept. no. ES 26803.
Order from LC mi$6.00, ph$19.80 PB 139 191

An investigation has been made to determine the smallest size of isolated roughness that will affect transition in a laminar boundary layer. The investiga-

tion was made in the Douglas El Segundo wind tunnel on a 108-inch-chord test surface designed to give large extents of laminar flow; the x-Reynolds number of transition $U_T x_T/\nu$ ranged from 2.0×10^6 to 7.4×10^6. Critical heights were found for three types of roughness over a range of variables larger than that covered by previous experiments.

Johns Hopkins U., Baltimore, Md.
EXTENDED APPLICATIONS OF HOT-WIRE ANEMOMETRY TO HIGH-SPEED TURBULENT BOUNDARY LAYERS, by Mark V. Morkovin and Ralph E. Phinney. Rept. on Experimental and Analytical Studies of Unsteady and Viscous Flows at High Speeds, Contract AF 18(600)1121. June 58, 152p. 50 refs. AFOSR TN-58-469; AD-158 279.
Order from LC mi$7.50, ph$24.30 PB 136 270

A hot-wire anemometer represents a non-linear system consisting of the flow-field, the wire, and the associated instrumentation. The method of extracting information from a heated thin wire, cooled by an unsteady compressible flow, based on the concept of local linearization around each operating point of the system, was extended to wires in yaw and to constant-temperature systems. An X probe was designed and used for boundary-layer measurements from which the Reynolds stress and the energy flux can be obtained. The results appeared to be consistent with plausible extrapolations of low-speed concepts. Procedures for measurements with single normal wires were clarified and improved.

Laboratorio di Meccanica Applicata del Politecnico di Torino (Italy).
OGIVE HAVING MINIMUM DRAG IN TWO-DIMENSIONAL HYPERSONIC FLOW, by Ennio Mattioli. Technical note 8 on Contract AF 61(514)1124. June 58, 35p. 14 refs. AFOSR TN-58-640; AD-162 171.
Order from LC mi$3.00, ph$6.30 PB 136 183

The ogive having minimum drag in hypersonic flow is determined for a given thickness, or for a given arc length, or for a given enclosed area. Fluid is assumed inviscid, the airfoil is assumed to be symmetric with zero incidence.

Midwest Research Inst., Kansas City, Mo.
ON THE EVALUATION OF GENERALIZED AERODYNAMIC FORCES FOR TRIANGULAR WINGS WITH SUPERSONIC LEADING EDGES, by Yudell L. Luke. Rept. on Contract AF 33(616)3058. 1 Oct 56, 39p. 5 refs. WADC Technical rept. 56-525; AD-143 294.
Order from LC mi$3.00, ph$6.30 PB 137 706

Computation of generalized aerodynamic forces for triangular wings with supersonic leading edges has been previously studied by J. W. Walsh, G. Zartarian, and H. M. Voss (see Ref. 1 of main text). A cursory examination of their procedure shows that the computation is extremely complicated. Here an efficient numerical procedure is developed. The present formulation leads to considerable simplification so that the arithmetic details are easily managed. Some numerical examples are presented.

National Advisory Committee for Aeronautics, Washington, D. C.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF TEMPERATURE RECOVERY FACTORS FOR FULLY DEVELOPED FLOW OF AIR IN A TUBE, by R. G. Deissler, W. F. Weiland, and W. H. Lowdermilk. Sep 58. 35p. 11 refs.
Order from NASA NACA TN-4376

The analysis was made for turbulent and laminar flow. The effect of wall temperature gradient along the tube was investigated but was important only at Mach numbers close to unity in the turbulent case. In the laminar case the effect became important at much lower Mach numbers. Recovery factors were obtained experimentally for a range of Reynolds number from 630 to 30,000. Additional previously unpublished data are presented for Reynolds numbers up to 650,000. The results indicate that for turbulent flow the recovery factor is approximately independent of Reynolds number. Comparison of analytical with experimental results indicates that the effective ratio of eddy diffusivities for heat transfer to momentum transfer varies with Reynolds number.

National Advisory Committee for Aeronautics, Washington, D. C.
APPLICATION OF THE METHOD OF COORDINATE PERTURBATION TO UNSTEADY DUCT FLOW, by Seymour C. Himmel (Case Inst. of Tech.) Doctoral thesis. Sep 58. 152p. 9 refs.
Order from NASA NACA TM-1439

Perturbation series solutions are obtained for the unsteady flow of a compressible fluid in ducts of variable cross section. Among the problems treated is that of the interaction of a disturbance and a shock wave in a diffuser flow. It is found that, for a special choice of the function describing the disturbance, the path of the shock wave can be expressed in closed form to first order. The flow field behind a shock wave moving on a prescribed path in the x, t-plane is also developed as a perturbation series.

National Advisory Committee for Aeronautics, Washington, D. C.
APPROXIMATE SOLUTIONS OF A CLASS OF SIMILARITY EQUATIONS FOR THREE-DIMENSIONAL, LAMINAR, INCOMPRESSIBLE BOUNDARY-LAYER FLOWS, by Arthur G. Hansen and Howard Z. Herzig. Sep 58, 26p. 18 refs.
Order from NASA NACA TN-4375

An analysis is presented for obtaining approximate solutions of the similarity equations for three-dimensional laminar-boundary-layer flows over a flat surface under main-flow streamlines that are translates and representable as infinite series expansions. For the particular case of streamline shapes described by a power of the distance along the surface from the leading edge, relatively simple expressions are obtained for flow deflection at the bounding surface, limiting streamline shape, and shear stress at the surface.

National Advisory Committee for Aeronautics, Washington, D. C.
AN EXPERIMENTAL INVESTIGATION OF THE

EFFECT OF VARIOUS PARAMETERS INCLUDING TIP MACH NUMBER ON THE FLUTTER OF SOME MODEL HELICOPTER ROTOR BLADES, by George W. Brooks and John E. Baker. Sep 58, 68p. 11 refs. Supersedes RM L53D24.
Order from NASA NACA TN-4005

Experimental studies have been made to evaluate the effects of parameters such as Mach number, blade angle, and structural damping on the flutter of model helicopter rotor blades in the hovering condition. The model blades had NACA 23012 and 23018 airfoil sections and each was tested at chordwise center-of-gravity locations of approximately 27.5 and 37 percent chord. Data were obtained at test-medium densities ranging from 0.0012 to 0.0030 slug per cubic foot and at various pitch angles up into the stall. Mixtures of air and Freon-12 were used for the test medium in order to extend the tip Mach number range of the tests to slightly above unity.

National Advisory Committee for Aeronautics, Washington, D. C.
EXPERIMENTAL MEASUREMENTS OF THE EFFECTS OF AIRPLANE MOTIONS ON WING AND TAIL ANGLES OF ATTACK OF SWEPT-WING BOMBER IN ROUGH AIR, by Jerome N. Engel. Aug 58, 25p. 11 refs.
Order from NASA NACA TN-4307

Flight-test data obtained from an airplane at an altitude of 5,000 feet are analyzed to determine the effects of airplane vertical translation and pitching motions. Power-spectral techniques are used in order to determine the contributions of these motions to the angles of attack of the wing and tail at various frequencies, and these results are compared with the direct gust-induced angle of attack.

National Advisory Committee for Aeronautics, Washington, D. C.
FORCE AND PRESSURE MEASUREMENTS AT TRANSONIC SPEEDS FOR SEVERAL BODIES HAVING ELLIPTICAL CROSS SECTIONS, by John B. McDevitt and Robert A. Taylor. Sep 58, 152p. 3 refs.
Order from NASA NACA TN-4362

The measured forces and static-pressure distributions at the body surface and in the surrounding flow field are presented. All of the bodies had an axial distribution of cross-sectional area equal to that for a parabolic-arc body of revolution having a fineness ratio of 12. The bodies were tested through an angle-of-attack range from 0° to 6° and through a Mach number range from 0.80 to 1.20.

National Advisory Committee for Aeronautics, Washington, D. C.
INVESTIGATION OF MINIMUM DRAG AND MAXIMUM LIFT-DRAG RATIOS OF SEVERAL WING-BODY COMBINATIONS INCLUDING A CAMBERED TRIANGULAR WING AT LOW REYNOLDS NUMBERS AND AT SUPERSONIC SPEEDS, by Clinton E. Brown and L. K. Hargrave. Sep 58, 62p. 19 refs. Supersedes RM L51E11
Order from NASA NACA TN-4020

Theoretical and experimental data for wing-body combinations with wings of triangular, arrow, and diamond plan form are presented for Mach numbers M of 1.62, 1.93, and 2.41 and a Reynolds number range of 1.4×10^6 to 0.7×10^6. Included are two each of triangular and arrow plan-form wings cambered for approximately uniform load at $M = 1.62$ and lift coefficients of 0.08 and 0.20. Liquid-film studies of the flow over the various configurations are also presented.

National Advisory Committee for Aeronautics, Washington, D. C.
AN INVESTIGATION OF SUPERSONIC TURBULENT BOUNDARY LAYERS ON SLENDER BODIES OF REVOLUTION IN FREE FLIGHT BY USE OF A MACH-ZEHNDER INTERFEROMETER AND SHADOWGRAPHS, by Alvin Seiff and Barbara J. Short. Sep 58. 57p. 18 refs.
Order from NASA NACA TN-4364

Measurement of the density distributions in supersonic turbulent boundary layers with large heat transfer by use of a Mach-Zehnder interferometer is described. The models are slender pointed bodies of revolution gun-launched in free flight at Mach numbers of 3.2 and 3.6 with length Reynolds numbers of 10 million and 25 million. Fluctuations of air density in these boundary layers are observed. The mean density distributions are compared with those given by the Crocco equation, and the mean heat transfer is computed from an energy balance and compared with that given by the modified Reynolds analogy.

National Advisory Committee for Aeronautics, Washington, D. C.
MEASUREMENTS IN A SHOCK TUBE OF HEAT-TRANSFER RATES AT THE STAGNATION POINT OF A 1.0-INCH-DIAMETER SPHERE FOR REAL-GAS TEMPERATURES UP TO $7,900^{\circ}$ R, by Alexander P. Sabol. Aug 58, 15p. 8 refs.
Order from NASA NACA TN-4354

The heat-transfer rates were determined at Mach numbers between 6.4 and 13.9 from measurements of the surface-temperature change with time of a thin-film-platinum resistance surface thermometer. The test results are presented and compared with the predictions of two theories, and the compatibility of these results with other experimental results obtained with both a thin-film surface thermometer and a calorimeter-type gage is pointed out. Data from tests in which a thin-film thermocouple was used are also included for comparison.

National Advisory Committee for Aeronautics, Washington, D. C.
MEASUREMENTS OF THE EFFECTS OF WALL OUTFLOW AND POROSITY ON WAVE ATTENUATION IN A TRANSONIC WIND TUNNEL WITH PERFORATED WALLS, by Joseph M. Spiegel, Phillips J. Tunnell, and Warren S. Wilson. Aug 58,

27p. 7 refs.
Order from NASA NACA TN-4360

Various wind-tunnel perforated-wall configurations were tested in the transonic speed range to evaluate the effects of wall outflow and wall porosity on the wave reflection on various models in the test section. The maximum outflow was 9.5 percent of the total mass flow and the porosity was varied from 0.60 to 24.4 percent open.

National Advisory Committee for Aeronautics, Washington, D. C.
ON POSSIBLE SIMILARITY SOLUTIONS FOR THREE-DIMENSIONAL INCOMPRESSIBLE LAMINAR BOUNDARY-LAYER FLOW OVER DEVELOPABLE SURFACES AND WITH PROPORTIONAL MAINSTREAM VELOCITY COMPONENTS, by Arthur G. Hansen (Case Inst. of Tech.) Doctoral thesis. Sep 58, 81p. 22 refs.
Order from NASA NACA TM-1437

Requirements for the existence of similarity solutions are obtained for boundary-layer equations expressed in orthogonal coordinates. Permissible forms of mainstream velocity components, the square of differential of arc length on the surface, and the similarity parameter are found. A basic class of surfaces is found from which all other permissible surfaces may be obtained. Necessary and sufficient conditions are found for expressing the ordinary differential equations resulting from the similarity transformation in uncoupled form. Uncoupling is possible only when the surface is developable and a surface coordinate system characterized by $(ds)^2 = (dx_1)^2 + (dx_2)^2$ is employed.

National Advisory Committee for Aeronautics, Washington, D. C.
SIMILAR SOLUTIONS FOR THE COMPRESSIBLE BOUNDARY LAYER ON A YAWED CYLINDER WITH TRANSPIRATION COOLING, by Ivan E. Beckwith. Sep 58, 72p. 27 refs.
Order from NASA NACA TN-4345

Heat-transfer and skin-friction parameters obtained from exact solutions to the laminar compressible boundary-layer equations for infinite cylinders in yaw are presented. The effects of transpiration cooling, Prandtl number, pressure gradient, wall temperature, and viscosity relation were investigated. It is shown that as the Mach number is increased for a given large yaw angle the effects of pressure gradient become larger and the quantity of coolant required to maintain a given wall temperature is also increased. The use of a linear viscosity-temperature relation gives approximately the same results as the Sutherland viscosity-temperature relation except for very high aerodynamic heating rates.

National Advisory Committee for Aeronautics, Washington, D. C.
SOME NUMERICAL SOLUTIONS OF SIMILARITY EQUATIONS FOR THREE-DIMENSIONAL LAMINAR INCOMPRESSIBLE BOUNDARY-LAYER FLOWS, by Peggy L. Yohner and Arthur G. Hansen. Sep 58, 76p. 7 refs.
Order from NASA NACA TN-4370

Numerical solutions are presented for two classes of similarity equations corresponding to a range of three-dimensional boundary-layer flows. Equations for limiting-flow deflection and equations for the calculation of boundary-layer streamlines are also presented.

National Advisory Committee for Aeronautics, Washington, D. C.
A THEORETICAL STUDY OF STAGNATION-POINT ABLATION, by Leonard Roberts. Sep 58, 29p. 6 refs.
Order from NASA NACA TN-4392

A simplified analysis is made of ablation cooling near the stagnation point of two-dimensional or axisymmetric body which occurs as the body vaporizes directly from the solid state. The automatic shielding mechanism is discussed and the important thermal properties required by a good ablation material are given. The results of the analysis are given in terms of dimensionless parameters.

National Advisory Committee for Aeronautics, Washington, D. C.
TRANSIENT TEMPERATURE DISTRIBUTION IN A TWO-COMPONENT SEMI-INFINITE COMPOSITE SLAB OF ARBITRARY MATERIALS SUBJECTED TO AERODYNAMIC HEATING WITH A DISCONTINUOUS CHANGE IN EQUILIBRIUM TEMPERATURE OR HEAT-TRANSFER COEFFICIENT, by Robert L. Trimpi and Robert A. Jones. Sep 58, 83p.
Order from NASA NACA TN-4308

A solution is obtained in the form of an infinite analytic series and the first six terms of the series are evaluated numerically and tabulated in a form to permit easy computation of heat-transfer problems typical to aerodynamic testing. Analytical results obtained from these solutions can be used to determine (a) the heat-transfer testing time for which the outer skin may be assumed to act as a calorimeter without exceeding a given error or (b) correction curves by which the indicated calorimeter heat-transfer coefficient may be multiplied to obtain the true heat-transfer coefficient. The problem of continuously varying equilibrium temperatures and heat-transfer coefficients may be treated by using the tabulated solutions and considering the continuous variation as a series of superimposed step functions.

Naval Ordnance Lab., White Oak, Md.
HEAT TRANSFER TO DRY ICE SPHERES SUBJECTED TO SUPERSONIC AIR FLOW, by E. C. Brooke. 1 Sep 57, 21p. 9 refs. NAVORD rept. 5719.
Order from LC mi$2.70, ph$4.80 PB 137 870

Heat transfer rates to a 5 cm diameter dry ice sphere for Mach number 1.86, 2.87, and 4.25 were determined from ablation experiments. Results are compared with heat transfer rates to a non-evaporative model subjected to the same flow conditions. This

report shows that heat conduction effects internal to the dry ice model are significant, especially at the highest Mach number tested, where the greatest change in environmental pressure occurred.

Naval Proving Ground, Dahlgren, Va.
EQUATIONS OF MOTION FOR A BODY WITH MASS ASYMMETRY, by C. H. Frick. 6 Aug 58, 31p. 4 refs. NPG rept. no. 1610.
Order from LC mi$3.00, ph$6.30 PB 137 558

The rigid body equations of motion presented in this report were formulated for the study of bodies reentering the atmosphere. They are suitable for solution on a large scale digital calculator and have been programmed for the Naval Ordnance Research Calculator (NORC).

Ohio State U. Research Foundation, Columbus.
PRESSURE DISTRIBUTIONS ON A 60 DEGREE FLAT DELTA AND ON A BLUNTED FLAT PLATE AT A NOMINAL MACH NUMBER OF 11.5, by John D. Lee. Final rept. for 13 June 57-16 May 58 on Subcontract to Bell Aircraft Corp. Contract AF 18(600)1607. June 58, 19p. Bell rept. D 143-978-016; ARDC TR-58-53; AD-131 472
Order from LC mi$2.40, ph$3.30 PB 135 748

A 60-degree flat delta and a flat plate having a leading edge diameter of 0.066 inch were each tested through an angle-of-attack range of $\pm$ 10 degrees at a nominal Mach number of 11.5 in the ALOSU continuous hypersonic wind tunnel. Pressures were measured by means of a sloping manometer bank, utilizing silicone fluid, at nominal Reynolds numbers of 0.516×10^6 and 0.206×10^6 per foot.

Polytechnic Inst. of Brooklyn, N. Y.
NOTE ON THE EFFECT OF CENTRIFUGAL FORCES AND ACCELERATED MOTION ON THE INSTABILITY OF THE LAMINAR BOUNDARY LAYER ABOUT HIGHLY COOLED BODIES, by Antonio Ferri and Roberto Vaglio-Laurio. Rept. on Contract AF 18(600)693. Dec 56, 16p. 3 refs. PIBAL rept. no. 313. AFOSR No. TN-56-579; AD-115 002.
Order from LC mi$2.40, ph$3.30 PB 139 282

A qualitative analysis indicates that centrifugal and body forces can produce instability of the laminar boundary layer when large temperature and density gradients normal to the surface exist due to cooling. Conversely, cooling can have a strong destabilizing effect in presence of large inertial forces.

Purdue U. School of Aeronautical Engineering, Lafayette, Ind.
EFFECT OF WARPING RESTRAINT ON TORSION PROBLEMS, by R. J. H. Bollard, Madeline Goulard, and Hsu Lo. Final rept. on Contract Nonr-423(00). Sep 57, 110p. 40 refs. Rept. no. S-57-1.
Order from LC mi$5.70, ph$16.80 PB 136 461

A theoretical study of the effect of secondary stresses, arising from warping restraint, and secondary deformations on the principal frequencies and mode shapes of cantilever, single cell box beams. An approximate solution, based on Hamilton's principle and the Calculus of Variations has been developed.

Rensselaer Polytechnic Inst., Troy, N. Y.
INVISCID FLOW AROUND A BLUNT BODY OF A REACTING MIXTURE OF GASES. PART A: GENERAL ANALYSIS, by W. Lick. Rept. on Contract AF 18(600)1591. May 58, 49p. 33 refs. TR AE 5810; AFOSR TN-58-522; AD-158 335.
Order from LC mi$3.30, ph$7.80 PB 136 214

A description is presented of a general numerical procedure whereby the details of inviscid flow about a blunt body of a mixture of perfect gases, including the effects of chemical reaction and relaxation, may be calculated. The fundamental equations and boundary conditions for the inviscid, nonheat conducting flow of a mixture of perfect gases are presented. The effects of vibrational relaxation and finite dissociation and recombination rates are included. An inverse method is described whereby if the form of the detached shock wave is known or is assumed, the flow field behind the shock and the corresponding shape of the body may be found. The method of solution and an iteration procedure to increase the accuracy of the computation are discussed. A method of characteristics for 2-dimensional flow including effects of vibrational relaxation and finite dissociation and recombination rates is developed; the speed of sound is also briefly discussed. A rough analysis of dissociation and recombination rates is made in order to perform numerical computations, by using the methods presented, and to obtain reasonable qualitative effects of finite reaction times.

Willow Run Research Center, U. of Michigan, Ypsilanti.
A SHOCK TUBE INVESTIGATION OF DETONATIVE COMBUSTION, by Richard Boyd Morrison. Rept. on Contract AF 33(038)12657. Jan 52, 135p. 36 refs. UMM-97; AD-20 347.
Order from U. of Michigan Press $3.25

The combustion of inflammable gaseous mixtures may be divided into two categories: deflagration or subsonic combustion waves, and detonation or supersonic waves. Detonations are analytically and experimentally investigated to determine the influence of various thermodynamic parameters on the dynamic properties of a non-adiabatic, one-dimensional flow system. Unsteady and steady flows are analyzed in the case of detonations occurring in long, one-dimensional ducts. The close connection between shock waves and detonation waves is discussed. From these analyses, a dimensionless heating parameter is derived which correlates all experimental detonation velocities when such velocities are expressed in terms of the Mach number of the detonation wave. The relation between the heating parameter and the Mach number of the detonation wave is substantiated by experimental investigations. Detonation waves were experimentally produced by means of shock ignition. The velocity of detonation waves was measured by means of a timing apparatus developed especially for this study. Spark

schlieren photographs indicate the existence of flow instabilities for the case of lean detonating mixtures.

Hydrodynamics, Hydraulics, and Hydrostatics

Brown U. Div. of Applied Mathematics, Providence, R. I.
PETURBATION OF FREE SURFACE FLOWS, by C. M. Ablow and W. D. Hayes. Technical rept. no. 1 on Contract N7onr-358(07). June 51. 80p.
ATI-108 648.
Order from LC mi$4.50, ph$12.30 PB 139 287

A method is established for the investigation of linearized time-varying perturbations of steady state two-dimensional incompressible flows with free surfaces. Two cases are investigated in detail. The first of these is that of the hollow vortex, for which the appropriate wave solutions found much earlier by Wm. Thompson are reproduced. The second of these is the case of the Borda mouthpiece, for which solutions are found in terms of hypergeometric functions. Boundary conditions are chosen which are essentially homogeneous, leading to solutions of a characteristic nature. All solutions which vary as $e^{\lambda t}$ with λ complex are of the decaying type with $R\ell\,\lambda<0$. With the customary notions of stability this implies the stability of the Borda mouthpiece flow.

David Taylor Model Basin, Washington, D. C.
THE INFLUENCE OF SHIP FORM ON PITCH AND HEAVE AMPLITUDES, by George P. Stefun. Sep 58, 23p. 13 refs. Rept. 1235.
Order from LC mi$2.70, ph$4.80 PB 137 182

The results of pitch and heave amplitude measurements are presented for five different models which were tested in regular waves representing head seas conditions. The data are given in the form of curves, at constant Froude numbers, of nondimensional motion parameters plotted against the ratio of the natural period to the period of encounter (tuning factor). It is shown that the motion results can be related, through empirical curves, to certain basic hull parameters which are developed and discussed in the report. Thus, the experimental data can be used to predict the motion amplitudes of various hull forms which have characteristics similar to those of the five models used in this investigation.

David Taylor Model Basin, Washington, D. C.
STEADY TWO-DIMENSIONAL CAVITY FLOWS ABOUT SLENDER BODIES, by M. P. Tulin. May 53, 25p. 11 refs. Rept. 834.
Order from LC mi$2.70, ph$4.80 PB 138 159

A linearized theory is developed for steady, two-dimensional cavity flows about slender symmetric bodies. The theory is applied to the cases of zero and nonzero (positive) cavitation numbers. It is shown that, for the case of finite cavities, the linearized theory avoids the necessity for choosing an artificial cavitation model as must be done in any exact theory attempts. The problem of calculating cavity shapes and drags for arbitrary slender bodies is reduced to one of quadratures. As an example, calculations are made for the family of wedge profiles and results are shown to be in good agreement with "exact" theory results for sufficiently slender bodies. In particular, the example demonstrates that the linearized theory is a valid first order theory.

David Taylor Model Basin, Washington, D. C.
A STUDY OF THE SEA BEHAVIOR OF A MARINER-CLASS SHIP EQUIPPED WITH ANTIPITCHING BOW FINS, by Ulysses A. Pournaras. Oct 58, 33p. 2 refs. Rept. 1084.
Order from LC mi$3.00, ph$6.30 PB 137 181

The results of model tests performed to determine the feasibility of reducing the pitching motion of the Mariner-type ship by means of fixed antipitching fins at the bow are presented. A 20-foot self-propelled model representing the final design of the Mariner-type ship was tested in waves with four antipitching fin configurations. Data are presented for both model and ship and are summarized in dimensionless form. The data are also used to compute the effect of the fins on the vertical motion and acceleration along the length of the ship.

David Taylor Model Basin, Washington, D. C.
VORTEX-INDUCED VIBRATION STUDIES, by Morris S. Macovsky. July 58, 17p. 6 refs. Rept. 1190.
Order from LC mi$2.40, ph$3.30 PB 137 515

The progress at the David Taylor Model Basin of basic studies concerning the mechanism of vortex-induced vibration of a circular cylinder is reviewed. Techniques for measuring lift and drag forces and for analyzing wake structure are presented. Measurements of the maximum alternating lift force coefficients in the Reynolds range $10^4<R<10^5$ are given. It is shown that these values are comparable to the drag coefficients at the low end of this Reynolds range, but diminish rapidly near 10^5. Breakdown of the two-dimensionality of the flow is presumed to be the explanation, judging from earlier flow studies.

European Office, Air Research and Development Command.
STATISTICAL STUDIES ON THE TURBULENT STATE OF MOTION. PART II: CONTRIBUTIONS TO DYNAMICS, by Hans Gebelein and Erik Svenson. Technical note no. 2 on Contract AF 61(514)925. Nov 57, 32p. 11 refs. AFOSR TN-58-45; AD-148 085.
Order from LC mi$3.00, ph$6.30 PB 136 189

It is an essential fact that most of these experimental data are defined by statistical concepts. Therefore, an appropriate theory of turbulence must also be based on statistical ideas. There can be no doubt about the fact that, under very general conditions, a fluid is able to move otherwise than it is predicted by classical hydrodynamic theory, namely in a highly irregular and unsteady manner which is characterised by diffusive movements on the molar rather than the molecular scale.

Hydrodynamics Lab., Calif. Inst. of Tech., Pasadena.
GROWTH OR COLLAPSE OF A SPHERICAL BUBBLE IN A VISCOUS COMPRESSIBLE LIQUID, by Forrest R. Gilmore. Rept. on Contract N6onr-244(26). 1 Apr 52, 43p. 8 refs. Rept. no. 26-4; ATI-207 805.
Order from LC mi$3.30, ph$7.80 PB 136 231

With the help of a hypothesis first proposed by Kirkwood and Bethe, the partial differential equations for the flow of a compressible liquid surrounding a spherical bubble are reduced to a single total differential equation for the bubble-wall velocity. The Kirkwood-Bethe hypothesis represents an extrapolation of acoustic theory and would be expected to be most accurate when all liquid velocities are small compared to the velocity of sound in the liquid. However, the present theory is found to agree quite well with the only available numerical solution of the partial differential equations which extends up to a bubble-wall velocity of 2.2 times the sonic velocity.

Hydrodynamics Lab., Calif. Inst. of Tech., Pasadena.
INCIPIENT CAVITATION AND BOUNDARY LAYER INTERACTION ON A STREAMLINED BODY, by B. R. Parkin and R. W. Kermeen. Rept. on Contracts N6onr-244(35) and NOrd-96(12). 1 Dec 53, 43p. 15 refs. Rept. no. E-35.2; AD-36 510.
Order from LC mi$3.30, ph$7.80 PB 139 624

A summary is presented of experiments that have provided the first results on the influence of the boundary layer on the inception of cavitation for smooth streamlined bodies. The experiments show that the neglect of the boundary layer is not justified. Tensions were observed for the first time and measured in the flow of ordinary water during incipient cavitation. These results show that the pressure distribution for noncavitating flow gives a good approximation to the actual pressures at cavitation inception as was previously assumed (AD-15 861). The tension measurements verify that when the macroscopic cavitation first becomes a clear attached cavity, the lowest pressure in the liquid increases so that bubble growth from dynamic causes cannot start. Microscopic bubble growth is significantly influenced by air diffusion, but only in the later stages of growth. The experimental trends were consistent with the view that microscopic bubbles are originally vapor bubbles which grow because there is a pressure unbalance across the bubble wall.

Hydrodynamics Lab., Calif. Inst. of Tech., Pasadena.
SCALE EFFECTS IN CAVITATING FLOW, by Blaine R. Parkin. Rept. on Contracts N6onr-244(20) and N6onr-244(35). 31 July 52, 41p. 9 refs. Rept. no. 21-8; AD-15 861.
Order from LC mi$3.30, ph$7.80 PB 139 628

Scale effects in cavitating flow are considered for the so-called limited cavitation flow regime. The effects on cavitation scaling of nuclei and dissolved air in ordinary water are considered. Previous work by the author is summarized and a theoretical study is made to gain insight into the relationships that must hold between the parameters which affect the inception of cavitation. A simplified theory gives only rough qualitative agreement with experiment.

Institute of Engineering Research, U. of California, Berkeley.
NOTE ON ASTERN REPLENISHMENT OF SHIPS IN ROUGH SEAS, by O. J. Sibul. Technical rept. on Maritime Cargo Transportation, Contract Nonr-222(36). Sep 57, 20p. 5 refs. Series no. 105; issue no. 2.
Order from LC mi$2.40, ph$3.30 PB 136 118

It is recognized that the present technique of parallel underway replenishment of a ship is not a continuous process. One way to achieve continuous underway cargo delivery is in-line, or tandem, or astern replenishment operation, provided wave motion would not cause excessive out of phase motions of the bow and stern of the delivery and the receiving ships. In this paper the problem of wave motion in relation to the in-line replenishing operation is discussed.

Naval Proving Ground, Dahlgren, Va.
COMPUTING PROGRAMS FOR SHIP WAVES, by A. V. Hershey. Apr 58, 60p. 1 ref. NPG rept. no. 1585.
Order from LC mi$3.60, ph$9.30 PB 135 860

It is planned to calculate the wave resistance of a ship of finite breadth in water of finite depth in two stages. In the first stage there will be two phases. In Phase No. 1, Fourier amplitudes in integrals of the Havelock type will be expressed by polynomial approximations, while in Phase No. 2, quadrilateral elements of the ship shape will be mapped on a plane square.

Stanford U., Calif.
ANTI-ROLL STABILIZATION OF SHIPS BY MEANS OF ACTIVATED FINS. PART A: THEORY AND DESIGN OF FINS, by Joseph H. Chadwick, Jr. Technical rept. no. 1 on Contract N6onr-251(29). 1 Feb 53, 135p. 81 refs. AD-6969.
Order from LC mi$6.90, ph$21.30 PB 139 288

A detailed discussion of the theory and design of stabilized fins is presented which is primarily devoted to the dynamics of the regulated elements. Three aspects of the problem are considered: the physical laws governing the behavior of fins, the parameters describing fin behavior, and the parameters affecting fin design. Pertinent design data are provided through an extensive bibliography. Recommendations are given for the design of fins for both retractable and nonretractable systems. Alternative designs are compared numerically with respect to drag, stabilizing power, and positioning moment and power.

Tennessee U. Engineering Experiment Station, Knoxville.
ANALYSIS OF TWO-DIMENSIONAL LAMINAR FLOW UTILIZING A DOUBLY REFRACTING LIQUID, by John W. Prados (Doctoral thesis) and

Fred N. Peebles. Final rept. on A Study of Laminar Flow Phenomena Utilizing a Doubly Refracting Liquid, Contract Nonr-811(04). June 57, 181p.
Order from LC mi$8.40, ph$28.80 PB 136 191

Statics, Kinematics, and Kinetics

Armour Research Foundation, Chicago, Ill.
DEVELOPMENTS IN THE APPLICATION OF THE GRID METHODS TO DYNAMIC PROBLEMS, by A. J. Durelli, J. W. Dally, and W. F. Riley. Rept. on Contract AF 18(603)144. Dec 58, 27p. 4 refs. AFOSR TN-58-893; AD-204 136.
Order from LC mi$2.70, ph$4.80 PB 137 783

The objective of the research reported in this paper was to further develop the grid method for use in dynamic stress studies. A rubber-thread grid network in a low modulus model material (a urethane rubber know as Hysol 8705) was used in conjunction with a microflash light source to record grid distortions and photoelastic fringe patterns in a model subjected to dynamic loading conditions. By considering a strut subjected to axial impact it was possible to establish that the static and dynamic values of Poisson's ratio were identical, and the strain fringe value of the material varied with strain rate. In addition, stresses in the axial and transverse directions were determined along the centerline of the strut. Finally, the methods established were applied to the problem of a circular disk subjected to diametrical impact and both principal stresses were determined along a vertical diameter at one instant during impact.

Armour Research Foundation, Chicago, Ill.
A PHOTOELASTIC APPROACH TO TRANSIENT STRESS PROBLEMS EMPLOYING LOW MODULUS MATERIALS, by J. W. Dally, W. F. Riley, and A. J. Durelli. Rept. on Contract AF 18(603)144. Dec 58, 33p. 16 refs. AFOSR TN-58-891; AD-204 138.
Order from LC mi$3.00, ph$6.30 PB 139 408

The objective of the program discussed in this paper was to develop a method, using photoelasticity and low-modulus materials, for studying dynamic stress distributions. Early in the program a number of low-modulus materials were studied and Hysol 8705 (a urethane rubber compound) was selected as the most promising. A complete study of its mechanical and optical properties was made under static and dynamic loadings. It was established that Poisson's ratio ν is independent of rate of loading, the stress fringe value f_σ is independent of rate of loading for strain rates greater than eight (8) in/in/sec., and both the modulus of elasticity E and the strain fringe value f_ε were dependent on the rate of loading. The specific energy loss for the material was about ten (10) percent for the stress ranges associated with photoelastic determinations.

Armour Research Foundation, Chicago, Ill.
PHOTOELASTIC STUDY OF STRESS WAVE PROPAGATION IN LARGE PLATES, by J. W. Dally, A. J. Durelli, and W. F. Riley. Rept. on Contract AF 18(603)144. 5 Nov 58, 30p. 8 refs. AFOSR TN-58-748; AD-162 271.
Order from LC mi$2.70, ph$4.80 PB 138 061

Dynamic photoelastic methods with a low modulus urethane rubber compound as the model material have been employed to study wave propagation in large plates. The loading was accomplished by using small package explosives in the form of electrical primers. The charges were placed at the corner and center of one long side of a large rectangular plate.

Armour Research Foundation, Chicago, Ill.
STRESS CONCENTRATION FACTORS UNDER DYNAMIC LOADING CONDITIONS, by A. J. Durelli. J. W. Dally, and W. F. Riley. Rept. on Contract AF 18(603)144. Dec 58, 25p. 4 refs. AFOSR TN-58-892; AD-204 137.
Order from LC mi$2.70, ph$4.80 PB 139 407

Dynamic photoelastic methods with a low modulus urethane rubber as the model material, were employed to study stress concentrations resulting from geometric discontinuities in rectangular bars subjected to an axial impact. The impact was applied by dropping a weight on one end of the bar, and the dynamic fringe patterns were photographed with both a Fastax camera and a microflash-still camera combination. The results of the investigation show that the maximum stress in a rectangular bar with a central circular hole occurs at the same minimum section for static or dynamic loading, and the stress concentration factors are the same. Whether the coincidence of the static and dynamic stress concentration factors is a general law remains to be established.

Pennsylvania State U., University Park.
STRESS WAVES OF PENETRATION IN PLATES, by Norman Davids. Interim technical rept. no. 12 on Scabbing and Fracture of Materials by Stress Waves, Contract DA 36-061-ORD-465. 1 Feb 58, 22p. 6 refs. AD-137 062.
Order from LC mi$2.70, ph$4.80 PB 136 166

Scabbing effects in plates may be analyzed theoretically by assuming elastic stress-waves excited periodically at a point-source on its boundary. The usual classical results are inaccurate since, first, the damaging wave is the one penetrating through the plate rather than propagating along it, and second, the dimensions of the plate in practical applications are just of the order of a wavelength. A more precise boundary-value problem is worked out and resulting axial stress-wave distributions for aluminum plates are given.

Stanford U., Calif.
LARGE (SECOND ORDER) TORSION OF ELASTIC BARS, by J. N. Goodier and W. A. Shaw. Rept. on Contract Nonr-225(29). Aug 57, 124p. 29 refs.
Div. of Engineering Mechanics Technical rept. no. 108.
Order from LC mi$6.30, ph$19.80 PB 136 430

The apparent discrepancies, and the hypothetical character of Weber's argument made it appear desirable to investigate large torsion of a bar of Hookean material as a problem in the exact theory. A complete (second-order) solution for the elliptical section is given in this report. Weber's prediction of a torsional stiffening is confirmed.

Stanford U., Calif.
PITCH AND CURVATURE CORRECTIONS FOR HELICAL SPRINGS, by Clinton J. Ancker, Jr. and J. N. Goodier. Rept. on Contract Nonr-225(29). Aug 57, 17p. 12 refs. Div. of Engineering Mechanics Technical rept. no. 105.
Order from LC mi$2.40, ph$3.30 PB 136 432

Stanford U., Calif.
THEORY OF PITCH AND CURVATURE CORRECTIONS FOR THE HELICAL SPRING. I (TENSION), by Clinton J. Ancker, Jr. and J. N. Goodier. Rept. on Contract Nonr-225(29). Aug 57, 41p. 5 refs. Div. of Engineering Mechanics Technical rept. no. 106.
Order from LC mi$3.30, ph$7.80 PB 136 431

Stanford U. Div. of Engineering Mechanics, Calif.
THEORY OF PITCH AND CURVATURE CORRECTIONS FOR THE HELICAL SPRING, II (TORSION) by Clinton J. Ancker, Jr. and J. N. Goodier. Technical rept. no. 107 on Contract Nonr 225(29). 1 Aug 57, 33p. 3 refs.
Order from LC mi$3.00, ph$6.30 PB 136 284

METALLURGY

Battelle Memorial Inst., Columbus, Ohio.
THE EFFECT OF RHENIUM ON THE FABRICABILITY AND DUCTILITY OF MOLYBDENUM AND TUNGSTEN, by R. I. Jaffee and C. T. Sims. Technical rept. on Contract Nonr-1512(00). 1 Apr 58, 41p. 15 refs.
Order from LC mi$3.30, ph$7.80 PB 138 570

The favorable effects of rhenium on the hot workability of molybdenum have been found to result from the redisposition of oxygen as a complex oxide or molybdate at rhenium contents over about 25 atomic per cent rhenium. The low-temperature ductility of the Mo-25 to 35 Re alloy is much better than that of molybdenum alone as a result of mechanical twinning and reduction of dislocation locking. The effects of rhenium on tungsten have been found to be similar, although the improvement in low-temperature ductility is less marked.

Naval Engineering Experiment Station, Annapolis, Md.
ANALYSIS AND TEST OF SOVIET METAL SAMPLES MCN 1828 AND MCN 1829, by L. Thompson. 25 Mar 53, 7p. 2 refs. Rept. no. EES-040037A.
Order from LC mi$1.80, ph$1.80 PB 137 424

Examination of samples of Soviet metals consisting of four sheet specimens found to be various grades of aluminum alloys and a lump commercially pure antimony. These materials compare favorably with American counterparts in regard to chemical composition.

New York U., N. Y.
TITANIUM-ALUMINUM-CHROMIUM ALLOYS, by E. Ence, H. Margolin, and J. P. Nielsen. Final rept. for 1 Feb 51-31 Jan 52 on Titanium Proj., Contract NOa(s) 51-331-c. [1952], 40p. 11 refs.
Order from LC mi$3.00, ph$6.30 PB 139 552

Data were obtained on the titanium-rich corner of the Ti-Al-Cr ternary phase diagram and the effects thereupon of 0.39 and 0.69% carbon additions. The data are presented in the form of isothermal and constant composition sections and are discussed in terms of information available in the literature. Phase relationships for four isothermal sections in the temperature region 650-1050°C and in the composition range up to 60% Cr and 45% Al have been prepared on the basis of data obtained from alloys containing up to 10% chromium or aluminum. Metallographic methods for specimen preparation and phase identification are described and characteristic microstructures are included.

Watertown Arsenal Labs., Mass.
THE DUCTILITY TRANSITIONS OF BODY-CENTERED CUBIC METALS, by F. R. Larson. Jan 58, 11p. 10 refs. Technical rept. WAL TR 805/34.
Order from LC mi$2.40, ph$3.30 PB 137 871

The ductile to brittle transition in body-centered cubic metals was studied. There appear, based on recently published test data, to be two types of ductility transitions. The first and most obvious, a reduction-of-area transition, is related to dislocation barriers. The second, a uniform-elongation transition, is related to the release of dislocations from Cottrell atmospheres. It is shown that both of these transitions may be caused by two competitive processes, one of which, in each case, is thermally activated. Recommendations are made on how these transitions may be reduced or eliminated.

Ferrous Metals

Armour Research Foundation, Chicago, Ill.
THE EFFECT OF METALLURGICAL VARIABLES ON THE FATIGUE PROPERTIES OF AISI 4340 STEEL HEAT TREATED IN THE TENSILE STRENGTH RANGE 260,000-310,000 PSI, by James I. Fisher and John P. Sheehan. Rept. for 1 Dec 55-30 Apr 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3299. Feb 59 [154]p. 1 ref. WADC Technical rept. 58-289; AD-208 321.
Order from OTS $3.00 PB 151 661

Eight heats of AISI 4340 were melted by several different methods in an effort to produce a variety of nonmetallic inclusions. The fatigue properties of these steels were studied at the 260,000-310,000 psi strength level by the rotating beam method using both standard and cylindrical R. R. Moore specimens. The endurance limits were determined by the Prot method and by the constant stress method. It was found, after a study of the size of the nonmetallic inclusions in each heat, that a fair correlation existed between the mean width of the largest inclusions and the ratio of endurance limit to ultimate tensile strength. The smaller the mean diameter of inclusions, the higher the endurance limit/tensile strength ratio. Experiments were also performed in an effort to determine the effect of reducing the amount of retained austenite and dissolved hydrogen and nitrogen on the fatigue properties. No effect was observed, possibly because of the overriding influence of large inclusions in the heat tested.

Babcock and Wilcox Co., Alliance, Ohio.
THE STRENGTHENING OF AUSTENITIC SOLID SOLUTIONS, by F. Eberle, J. H. Hoke, and others. Rept. for 15 June 56-15 Dec 57 on Metallic Materials, Contracts AF 33(616)2413 and AF 33(616)5208. Apr 58 [70]p. WADC Technical rept. 58-28; AD-151 161.
Order from OTS $1.75 PB 131 992

Among vacuum-melted wrought carbon-free alloys of Fe-Cr-Ni, Fe-Cr-Co, and Fe-Cr-Ni-Co, the compositions 10Fe-20Cr-70Ni and 20Cr-80Co have shown the highest 100-hour rupture strength at 1800°F. Strengthening susceptibility studies with these two base compositions by solid solution hardening, complex carbide hardening, and intermetallic compound hardening revealed that the nickel base responds most effectively to intermetallic compound hardening with Ti and Al, less so to complex carbide hardening, and not at all to solid solution hardening. The cobalt base responds to all three methods of strengthening; however, it does not attain as high a level of rupture strength at 1800°F as the nickel-base alloys.

California U., Berkeley.
INVESTIGATIONS ON THE VALDITY OF AN IDEALIZED THEORY OF PLASTIC FLOW FOR ROLLED MILD STEELS, by C. H. Avery, T. E. Tietz, and J. E. Dorn. Technical rept. no. 4 on Contract no. N6ori-111(04). Dec 47, 55p. 7 refs. ATI-36 854.
Order from LC mi$3.60, ph$9.30 PB 139 622

Tensile and bulging tests were made on a mild steel plate in order to correlate its plastic behavior under simple tensile and equal biaxial tensile stressing. The plastic strains which were obtained in tension and during bulging revealed that the steel was anisotropic. Since practically identical tensile stress-strain curves were obtained at 0°, 45°, and 90° to the rolling direction, the anisotropy was identified as planar isotropy. Various formulations of generalized work hardening functions for anisotropic metals were tested to determine which provided the best correlation between the tension and bulging data. The assumption that the generalized flow stress is a function of the plastic strain energy gave only fair correlation. When, however, this same assumption was formulated for complete three dimensional isotropy, better agreement was obtained. These results illustrate the need for a more appropriate assumption for correlating the work hardening characteristics of anisotropic metals.

Illinois U. Engineering Experiment Station, Urbana.
THE EFFECTS OF INELASTIC ACTION ON THE RESISTANCE TO VARIOUS TYPES OF LOADS OF DUCTILE MEMBERS MADE FROM VARIOUS CLASSES OF METALS. PART 8. ECCENTRICALLY LOADED TENSION MEMBERS MADE OF TWO STAINLESS STEELS TESTED AT ELEVATED TEMPERATURES, by O. M. Sidebottom, M. E. Clark, and S. Dharmarajan. Rept. for Feb 57-Feb 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)2753. Oct 58, 61p. WADC Technical rept. 56-330, Part 8; AD-202 495.
Order from OTS $1.75 PB 151 673

This report presents the results of an analytical and experimental investigation for the determination of the load necessary to produce a specified amount of inelastic deformation in rectangular-section members subjected to eccentric tensile loads at elevated temperatures. Two different theories were used. In one theory each isochronous stress-strain diagram was represented by two straight lines, and the load and deflection of the eccentrically loaded members were obtained from interaction curves and moment-load curves. In the other theory each isochronous stress-strain diagram was represented by a hyperbolic sine curve, and the resultant theory is called the hyperbolic sine theory. In the experimental investigation, tests were made on eccentrically-loaded rectangular-section members made of type 304 stainless steel at a test temperature of 1000°F and 17-7 PH stainless steel at test temperatures of 1000°F and 1200°F. Some of the 17-7PH stainless steel specimens were given a precipitation hardening treatment and some were tested in the untreated condition. (See also PB 131 556)

Illinois U. Engineering Experiment Station, Urbana.
THE EFFECTS OF INELASTIC ACTION ON THE RESISTANCE TO VARIOUS TYPES OF LOADS OF DUCTILE MEMBERS MADE FROM VARIOUS CLASSES OF METALS. PART 9. T-SECTION ECCENTRICALLY-LOADED TENSION MEMBERS MADE OF TYPE 304 STAINLESS STEEL AND TESTED AT 1000°F, by O. M. Sidebottom and S. Dharmarajan. Rept. for Feb-June 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)2753. Oct 58, 18p. WADC Technical rept. 56-330, Part 9; AD-202 496.
Order from OTS $0.50 PB 151 674

This report presents the results of an analytical and experimental investigation for the determination of the load necessary to produce a specified amount of inelastic deformation in T-section members subjected to eccentric tensile loads at 1000°F. The interaction curve-moment-load curve theory was used in predicting the load and deformation of the eccentrically-loaded members. The material used in making the test members was type 304 stainless steel. Creep

tension tests indicated that this material was extremely time-insensitive, at least, for the first 30 minutes. The stress-strain diagram of the material at 1000°F was similar in shape to that at room temperature. (See also PB 151 673)

Metallurgical Research Labs., Syracuse U., N. Y.
HARDENABILITY STUDIES ON 4340 STEEL, by E. P. Klier, V. Weiss, and G. Sachs. Final rept. no. 1 on Contract NOas-54-424-c. Oct 54, 46p. 8 refs.
Order from LC mi$3.30, ph$7.80 PB 130 766

The Jominy hardenability test has been performed on a number of 4340 steel specimens after various heat treatments. The hardenability was found to depend to a marked degree on the austenitizing schedule. When Jominy-quenched from the austenitizing temperature (between 1500°F and 1600°F) upper bainite was always present from about the middle to the free-cooling end of the specimen. Isothermal holding in the range of 1325°F for about 1 hour resulted in a suppression of the formation of upper bainite within some treatments, this leading to an increase of the hardenability. X-ray studies were made after a selected number of heat treatments.

Naval Research Lab., Washington, D. C.
EFFECT OF PRIOR COLD WORK ON THE HIGH-TEMPERATURE PROPERTIES OF A CHROMIUM-MOLYBDENUM STEEL, by Paul Shahinian. Final rept. 3 June 55, 21p. 16 refs. NRL rept. 4550.
Order from LC mi$2.70, ph$4.80 PB 139 594

The effect of cold work on the high-temperature properties of a quenched and tempered chromium-molybdenum steel was investigated by means of stress-rupture and relaxation tests. The material with several levels of cold reduction (0, 8, 15, and 39% of cross-sectional area) was tested in stress-rupture at 700°, 800°, 900°, and 1000°F (370°, 425°, 480°, and 540° C) in the stress range of 45,000 to 128,000 psi, and in relaxation at 900°F (480°C) and 80,000 psi initial stress.

Naval Research Lab., Washington, D. C.
THE PARTITIONING OF ALLOYING ELEMENTS IN MALLEABLE IRONS, by George Sandoz. 16 Feb 59, 27p. 33 refs. NRL rept. 5268.
Order from OTS $0.75 PB 151 413

The partitioning of a number of alloying elements between the cementite and austenite phases of irons during first-stage graphitization has been determined. For the most part, the data were obtained by chemical analyses of the cementite chemically extracted from irons quenched after selected periods at 1650°F. Spot checks of these results and some explorations of alloy distribution in the matrix were made with the electron probe microanalyzer.

Naval Research Lab., Washington, D. C.
A REMOTELY CONTROLLED DROP-WEIGHT TEST MACHINE FOR BRITTLE-FRACTURE STUDIES, by L. E. Steele and J. R. Hawthorne. Final rept. 18 Feb 59, 7p. 2 refs. NRL rept. 5278.
Order from OTS $0.50 PB 151 500

In order to study the effects of nuclear radiation on the notch-impact properties of large steel specimens, remotely controlled drop-weight test equipment has been designed for use in the NRL Metallurgy Division hot-cell facility. The drop-weight test has been used to define the control temperature below which steel structures may potentially initiate brittle fractures in the presence of sharp notches or flaws. The test is to be applied for the determination of embrittlement due to radiation.

Southern Research Inst. [Birmingham, Ala.]
DETERMINATION OF TENSILE, COMPRESSIVE, BEARING AND SHEAR PROPERTIES OF SHEET STEELS AT ELEVATED TEMPERATURES, by J. Robert Kattus, James B. Preston, and Herman L. Lessley. Rept. for Jan 57 to May 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3876. Nov 58, 299p. 12 refs. WADC Technical rept. 58-365; AD-206 075.
Order from OTS $4.00 PB 151 592

The tensile, compressive, bearing, and shear properties of the following sheet metals were determined at various temperatures after exposure times of from 1/2 hour to 1000 hours at the test temperature:
(1) A-286 austenitic alloy, quenched and tempered;
(2) 17-7 PH stainless steel, RH 950 condition;
(3) Thermold J alloy steel, quenched and tempered;
(4) Type 420 stainless steel, quenched and tempered;
(5) Type 422 stainless steel, quenched and tempered; and
(6) 17-22 A (S) alloy steel, quenched and tempered.
The A-286 alloy was tested over a temperature range from 75° to 1200° F, the Thermold J from 75° to 1100° F, and the other alloys from 75° to 1000° F. In all of the test alloys, the strength properties and moduli of elasticity decreased with increasing temperatures. The strength properties of the Thermold J, Type 420, Type 422, and 17-22 A (S) tended to decrease by varying amounts with increasing exposure times at the higher test temperatures. These decreases in strength are believed to be associated with structural changes produced by tempering. The simple ratio relationships between various properties under equivalent test conditions were approximately equal in magnitude and in consistency of those previously determined for other materials and reported in WADC Technical Report 56-340 (PB 131 461). For the entire ranges of materials and conditions used in this work, the consistency of the various property relationships ranged from ±17%. to ±71%. Precise data on the mechanical properties of aircraft-structural materials can be obtained only by testing under the desired condition

Light Metals

Armour Research Foundation, Chicago, Ill.
SURFACE HARDENING OF TITANIUM WITH METALLOID ELEMENTS, by R. W. Hanzel and V. Pulsifer. Interim technical rept. no. 3, 1 June-30 Nov 52, on Contract DA-11-022-ORD-289. 42p. 4 refs. WAL File 401/84-20.
Order from LC mi$3.30, ph$7.80 PB 139 166

Treatment of commercial titanium, the special binary alloys and several commercial alloys in a purified nitrogen atmosphere develops a relatively hard, adherent case between 1500°F (815°C) and 1800°F 983°C). Titanium-base vanadium and boron alloys develop hard, adherent cases in the 1200°F (649°C) to 1400°F (760°C) temperature range. An extremely hard but shallow and rough surface is developed on titanium by an electrolytic treatment in molten borax. The increase in nitrogen content of the material is reflected by a drop in impact values.

Battelle Memorial Inst., Columbus, Ohio.
AN INVESTIGATION OF THE EFFECTS OF IMPURITIES AND METALLURGICAL VARIABLES ON THE NOTCH SENSITIVITY OF TITANIUM ALLOYS, by Frank C. Holden, Richard W. Douglass and others. Rept. on Metallic Materials, Contract AF 33(616)5007. Dec 58, 87p. 4 refs. WADC Technical rept. 58-438; AD-207 078.
Order from OTS $2.25 PB 151 624

The notch tensile properties of three commercial titanium-base alloys, A110AT (Ti-5.0Al-2.5Sn), Ti-6Al-4V, and Ti-140A (Ti-2Fe-2Cr-2Mo), were investigated at six interstitial levels, four microstructural conditions, and over a range of temperatures from −196° to 200°C. Notch sensitivity generally was increased by increased interstitial content, low temperature, and acicular-type microstructures. In addition, sensitivity to slow-strain hydrogen embrittlement was observed in the temperature range near 0°C at hydrogen levels well below specification limits.

Chase Brass and Copper Co., Inc. Waterbury, Conn.
HEAT TREATMENT RESPONSE, MECHANICAL PROPERTIES AND STABILITY OF TITANIUM SHEET ALLOYS, by Eugene Delgrosso, Peter Kuzmenko and others. Rept. on Metallic Materials, Contract AF 33(616)3585. Jan 59, 117p. 28 refs. WADC Technical rept. 58-409; AD-207 791.
Order from OTS $2.50 PB 151 623

The effect of various heat treatments on the mechanical properties of two titanium alloys was determined. The two types of heat treatments utilized were: (1) solution treatment and water quench, (2) solution treatment, water quench and age. The alloys, Ti-4Al-3Mo-1V and Ti-15V-2.5Al, were investigated in the form of approximately 0.040" sheet. Three interstitial content levels of each alloy were investigated. Beta transus temperatures were determined for the alloys. Room temperature mechanical properties were evaluated for the solution treated and aged conditions of the alloys for both standard and notched tensile configurations. Elevated temperature tensile properties were determined. The effect of deformation, via two degrees of rolling or stretching, on aging characteristics was ascertained. Three hundred hour creep tests were conducted at 600° F and 800° F. Creep embrittlement was evaluated. A microstructural examination was conducted. Also, the alloy Ti-4Al-1Pb-1Sn-1V-1Zr was prepared in sheet form and some of its mechanical properties were evaluated.

Crane Co., Chicago, Ill.
DETERMINATION OF TESTS FOR HYDROGEN EMBRITTLEMENT OF TITANIUM ALLOYS, by Albert H. Fleitman. Rept. for Jan 56 - Mar 57 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3244. Dec 57, 127p. 15 refs. WADC Technical rept. 57-470; AD-142 196.
Order from OTS $2.75 PB 131 617

The mechanical properties of two commercial alloys, Ti-8 Mn were investigated in the as received, helium annealed, vacuum annealed, and 150, 225 and 300 ppm hydrogen conditions. Slow room temperature notched and unnotched tensile and tensile stress rupture tests up to 1000 hours were performed on both alloys. Slow room temperature notched and unnotched torsion, bend and bend stress rupture tests up to 1000 hours were made on Ti-4 Al-4 Mn alloy. None of the unnotched specimens in any of these tests failed in a brittle manner. The notched tensile stress rupture tests showed that the stress required for fracture at a given time slightly decreased with increasing hydrogen content. In contrast, the notched bend stress rupture tests showed an increase in stress required for fracture. Comparison of results in this investigation with earlier work on hydrogenized specimens of these titanium alloys indicates that brittle fractures would have been expected in both alloys when tested in stress rupture at the 300 ppm hydrogen level.

[Defense Metals Information Center] Battelle Memorial Inst., Columbus, Ohio
MEMORANDUM ON THE EMISSIVITY OF TITANIUM. 15 Mar 57, 6p. 9 refs. Supersedes, in part, data of TML rept. no. 39
Order from LC mi$1.80, ph$1.80 PB 139 551

Data on emissivities of different grades of titanium at various temperatures and from several references are summarized.

Industrial Test Lab., Philadelphia Naval Shipyard, Pa.
INVESTIGATION OF THE RADIOGRAPHY OF ALUMINUM USING IRIDIUM 192, by T. F. Boyd and M. Galan. Nov 57, 19p. 5 refs. Research and Development rept. no. 6200E-5.
Order from LC mi$2.40, ph$3.30 PB 138 007

Iridium 192 is a practical source for the radiography of aluminum when x-rays cannot be used.

New York U. Coll. of Engineering, N. Y.
RESEARCH AND DEVELOPMENT WITH RESPECT TO THE Ti-Al-O SYSTEM, by E. Ence and H. Margolin. Final rept. on Contract DA 30-069-505-ORD-1781. June 57, 35p. 22 refs. WAL 401/214-4.
Order from LC mi$3.00, ph$6.30 PB 138 761

Evidence has been adduced which required modification of the previously accepted Ti-Al diagram. There is basis, for believing that Ti_2Al forms peritectically by the reaction $L + \beta \rightarrow Ti_2Al$ and that TiAl also forms peritectically by the reaction $L + Ti_2Al \rightarrow TiAl$.

Watertown Arsenal, Mass.
RECOMMENDED METHODS OF THE PANEL ON METHODS OF ANALYSIS. 11 Sep 58, 65p. Metallurgical Advisory Committee on Titanium Information Bull. no. T8, part 2.
Order from LC mi$3.90, ph$10.80 PB 138 217

Part I of Bulletin No. T8 included methods recommended by the Panel on Methods of Analysis of Titanium for Iron, Chromium, Molybdenum, Vanadium, Tin, Aluminum, Manganese, Nitrogen, and for Spectrochemical Analysis. Part II includes recommended methods for Carbon, Chloride, Magnesium, Silicon, Tungsten, and Oxygen (and Hydrogen) by Vacuum Fusion, and a suggested method for Boron in titanium metal and alloys.

Watertown Arsenal Labs., Mass.
THE ROOM TEMPERATURE STRAIN RATE SENSITIVITY OF ANNEALED TITANIUM AND TITANIUM ALLOYS, by Frank R. Larson and Eric B. Kula. Apr 58, 61p. 9 refs. Technical rept. on. WAL TR 401/295.
Order from LC mi$3.90, ph$10.80 PB 138 410

The strain rate sensitivity of 6 heats of commercially pure titanium and 6 heats of alpha-beta titanium alloys in wire form has been determined at room temperature over a range of strain rates from 0.002 to 1.0 inches/inch/minute. An analysis of the results shows that the strain rate sensitivity varies with the logarithm of the strain, and the strain hardening exponent with the logarithm of the strain rate. Moreover, the strain rate sensitivity and strain hardening exponent are shown to vary linearly with the stress on log-log coordinates. The importance of stress level in controlling these variables is supported by other results from published literature.

Structural Metallurgy and Corrosion

Aeronautical Engine Lab., Naval Air Material Center, Philadelphia, Pa.
ENGINE EVALUATION OF ETHYL CORP. 2, 6 DITERTIARY BUTYL PHENOL OXIDATION INHIBITORS, by S. H. Shertzer. Final rept. on Proj. TED-NAM-PP-5220. 17 July 57, 19p. NAMC-AEL-1524.
Order from LC mi$2.40, ph$3.30 PB 136 239

This report presents the results of the evaluation of 2, 6 ditertiary butyl phenol for suitability as an oxidation inhibitor in MIL-G-5572B fuels. This inhibitor has proved satisfactory.

Army Chemical Warfare Labs., Army Chemical Center, Md.
ANTISET, DECONTAMINATING SLURRY, E4, AND DECONTAMINATING APPARATUS, POWER-DRIVE, TRUCK-MOUNTED, E9, by Mortimer Fleishhacker, III and Edward N. Eitel. Final engineering test nos. 145 and 147. Aug 58, 79p. CWLR 2229.
Order from LC mi$4.50, ph$12.30 PB 138 161

On the basis of test results, it is concluded that: 1. The E4 decontaminating slurry antiset adequately prevents the setting of decontaminating slurries and meets adopted design characteristics. 2. The E9 truck-mounted, power-driven, decontaminating apparatus is adequately designed to serve as an improved model of the standard M3A3 apparatus and is generally satisfactory as regards meeting the approved military/technical characteristics for this type of item. 3. Consideration should be given to incorporating suggested design changes in the production model of the E9 decontaminating apparatus, thereby eliminating the minor deficiencies noted in the prototype.

Materials Research Lab., Rutgers U., New Brunswick, N. J.
EARLY AGING EFFECTS IN COPPER-1.76% BERYLLIUM SINGLE CRYSTALS, by Doris I. Evans. Technical rept. no. 8 on Contract Nonr-404(09). Oct 57, 49p. 20 refs.
Order from LC mi$3.30, ph$7.80 PB 136 460

Strains incurred during aging result in the early fragmentation of the original grains in the polycrystalline material and of the subgrains in the single crystals indicate that grain size refinement is a primary cause of the early increase in hardness. This refinement is associated with a reconstitution of the material that proceeds, at 200°C, as a short-range order transformation characterized by a relatively high rate of nucleation and a low rate of growth, and not as a precipitate transformation.

Minnesota U., Minneapolis.
FATIGUE, CREEP, AND RUPTURE PROPERTIES OF THE ALLOYS UDIMET 500, HASTELLOY R-235, AND GMR-235, by F. H. Vitovec. Rept. for Jan 56 to Dec 57 on Materials Analysis and Evaluation Techniques, Contracts AF 33(616)2803 and AF 33(616)5449. Oct 58, 72p. 7 refs. WADC Technical rept. 58-340; AD-202 502.
Order from OTS $2.00 PB 151 608

Fatigue, rupture, and creep data at 1200° and 1650° F obtained under various combinations of mean and alternating stress are presented. Tests were performed under axial stress on unnotched specimens and specimens having a theoretical stress concentration factor of 3.4. The data are presented as S-N curves and stress range diagrams to show the effect on the fatigue and creep properties of stress concentration, temperature, ratio of alternating-to-mean stress, and stress magnitude.

National Advisory Committee for Aeronautics, Washington, D. C.
AN INVESTIGATION OF THE EFFECTS OF ATMOSPHERIC CORROSION ON THE FATIGUE LIFE OF ALUMINUM ALLOYS, by Herbert A. Leybold, Herbert F. Hardrath, and Robert L. Moore. Sep 58, 17p. 1 ref.
Order from NASA NACA TN-4331

Fatigue tests were conducted on 100 vibrating cantilever sheet specimens by applying 4,000 cycles of load in a 10-minute period each working day while

the specimens were subjected to atmospheric conditions over a period of several months. Specimens of 2024-T3 and 7075-T6 aluminum alloys in both the bare and clad forms were tested. For comparison, 96 specimens were tested indoors. Atmospheric effects shortened the average lives of the specimens by a factor of about 3 for 7075-T6 and 2024-T3 in the bare condition and by a factor of about 1.5 for 7075-T6 in the clad condition, and had no significant effect on the average life of 2024-T3 clad specimens.

National Bureau of Standards, Washington, D. C.
EROSION PROTECTION FOR AIRCRAFT COMPONENTS, by J. R. Cuthill and W. N. Harrison. Rept. on Contract [AF] 33(600)52-4210. Apr 56, 58p. 6 refs. WADC Technical rept. 56-130; AD-104 158.
Order from LC mi$3.60, ph$9.30 PB 135 541

An investigation was conducted to determine the ability of ceramic coatings, representative of those currently being applied commercially, to protect alloys in high-temperature service that are subject to impingement erosion by hot gases.

Naval Boiler and Turbine Lab., Philadelphia, Pa.
FUEL OIL ASH CORROSION RESISTANCE OF 60:40 CHROMIUM-IRON ALLOY, by J. R. Witmeyer. Evaluation rept. 26 June 57, 21p. NBTL Test R-252.
Order from LC mi$2.70, ph$4.80 PB 136 267

Using high vanadium and high sodium corrodents at 1700°, 2000° and 2200° F., 60Cr:40Fe alloy showed the best corrosion resistance followed by 60Cr:40Ni then 50Cr:50Ni and the least resistance was displayed by 25Cr:20Ni. Utilization of the 60Cr:40Fe alloy for boiler parts is doubtful because of poor oxidation resistance.

Naval Engineering Experiment Station, Annapolis, Md.
TESTING OF VARIOUS MATERIALS IN HIGH TEMPERATURE WATERS, by C. J. Lancaster. 30 Nov 53, 22p. Rept. no. EES-040028D.
Order from LC mi$2.70, ph$4.80 PB 138 002

The following tests were conducted: Dynamic autoclave tests at 350°F on stressed specimens in natural sea water, at 120°F on stressed specimens in natural sea water, stress corrosion tests of Type 347 stainless steel tubes in boiler feedwater solutions, and corrosion effects produced in stainless steel test equipment by chloride solutions at elevated temperatures.

Rock Island Arsenal Lab., Ill.
COMPARATIVE CORROSION RESISTANCE TESTS ON PHOSPHATE COATINGS, by Jodie Doss. 15 July 58, 13p. 3 refs. Rept. no. 58-1842.
Order from LC mi$2.40, ph$3.30 PB 136 143

Comparative accelerated corrosion tests on zinc and manganese phosphate coatings were the salt spray test (5 and 20 percent solutions), Springfield Armory Linear Flow Immersion test and the Rock Island Arsenal Boil test. A two hour salt spray test on zinc phosphate coatings was found to be equivalent to a ten minute test in the linear flow immersion test or to passing of the "Boil" test. A one hour test in the salt spray cabinet of the manganese phosphate coating was equivalent to a ten minute test in the linear flow immersion test.

Rock Island Arsenal Lab., Ill.
STABILITY CHARACTERISTICS OF MIL-L-3150 OILS, by Robert E. Johnson. 23 July 58, 13p. Rept. no. 58-1895.
Order from LC mi$2.40, ph$3.30 PB 136 142

The stability characteristics of MIL-L-3150 oils were determined after accelerated and long term tests. The viscosity characteristics were determined on original and exposed samples. The work indicated that most MIL-L-3150 materials do not separate or gel under accelerated or long term storage conditions. Viscosity results indicated that only one of nine materials evaluated exhibited a significant change in viscosity.

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Naval Radiological Defense Lab., San Francisco, Calif.
ANNUAL REPT. 1956. 45p. 90 refs. AD-149 041.
Order from LC mi$3.30, ph$7.80 PB 139 358

Air Force Cambridge Research Center, Bedford, Mass.
RADIOCHEMISTRY SECTION, COMPONENTS AND TECHNIQUES LABORATORY, Quarterly progress rept. nos. 1-2,1 Jan-30 June 57. 44p. 4 refs. AFCRC TN-122; AD-146 831.
Order from LC mi$3.30, ph$7.80 PB 137 982

Studies continued on chemical purification techniques for transistor silicon and silicon iodide, especially in regard to zone purification and apparatus. Therefore, neutron activation analyses of silicon and dissolution of silicon carbide, diffusion of dopants into silicon, correlation of radiotracer techniques, effects of nuclear radiation on electronic materials, and several other projects carried on by the four units of the section.

Elementary Particles

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
THERMAL AND EPITHERMAL NEUTRON ACTIVATION IN A THICK STEEL SLAB, by R. D.

Schamberger and A. N. Fasano. Oct 57, 23p. WADC TN-57-347; AD-142 060.
Order from LC mi$2.70, ph$4.80 PB 136 846

The activation of gold, indium, and nickel foils by neutrons originating in a fission source has been investigated within a nine-inch steel slab and in water and polyethylene following the steel. The measurements indicate a large epithermal activation in the steel so that the insertion of layers containing boron at the boundaries of the steel effected only a small reduction in the activation.

St. Louis U., Mo.
ELASTIC AND INELASTIC SLOW NEUTRON SCATTERING BY THE EINSTEIN METHOD, by R. M. Delaney and A. H. Weber. Final technical rept. part 1, 1 Nov 52-31 Oct 58 on Neutron Diffraction Study of the Structure of Glasses, Contracts DA 23-072-ORD- (473, 593). 15 Nov 58, 28p. 9 refs.
Order from LC mi$2.70, ph$4.80 PB 139 093

An investigation was conducted to determine the extent of embrittlement of Cr-Mo-V steel resulting from chromium plating and the possible reduction of this embrittlement by subsequent heat-treatment. Tensile and tensile impact tests were made on Cr-Mo-V steel. Test procedures are described and results given.

Stanford U., Calif.
NEW TECHNIQUES IN THE LAMB SHIFT CALCULATION, by H. M. Fried and D. R. Yennie. Technical rept. no. 36 on Contract AF 49(638)388. July 58, 44p. 18 refs. Rept. no. 388-36; AFOSR TN 58-678; AD-162 210.
Order from LC mi$3.30, ph$7.80 PB 138 979

Based on the analogy between the calculations of radiative corrections to electron scattering and the lamb shift, a new procedure applicable to bound state self-energy problems is developed, wherein the electron propagator is expanded in powers of the external potential.

Instruments and Installations

Armour Research Foundation, Chicago. Ill.
PHOTO-CONDUCTIVE MATERIALS FOR USE IN HIGH INTENSITY NUCLEAR RADIATION MEASUREMENTS, by Robert J. Robinson and Leonid V. Azaroff. Rept. for 1 June 56-31 July 57 on Nuclear Instrumentation, Contract AF 33(616)3762. 6 Nov 57, 61p. 14 refs. WADC Technical rept. 57-627.
Order from OTS $1.75 PB 151 258

The major accomplishment of this program is the correlation of gamma ray induced photoconductivity to the well known visible light induced photoconductivity. The phenomenological theory of photoconductivity is shown to apply to the gamma ray region as well as to the visible light region. The energy dependence observed in the response to CdS crystals is shown to be due to the energy dependence of the absorption process. The average ionization energy is shown to be in good agreement with independent measurements employing alpha and beta rays. Two methods for growing single crystals, a flow system and a static system, were employed in the preparation of single crystals of cadmium sulfide. These can be grown large enough for device purposes, and with the desired electrical properties by control of the impurities added. Polycrystalline detectors can be prepared in several ways; however, their response properties are not as good as those obtained with single crystals.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
ON RENEWAL PROCESSES RELATED TO TYPE I AND TYPE II COUNTER MODELS - THE GENERAL COUNTER PROBLEMS, by Ronald Pyke. Technical rept. no. 37 on Contract N6onr-251(40). 21 Oct 57, 33p. 8 refs.
Order from LC mi$3.00, ph$6.30 PB 136 465

Convair, Fort Worth, Tex.
HEALTH PHYSICS ACTIVITIES, ed. by R. F. Shockley, W. R. Miller and W. F. Cockrell. Rept. for 1 Oct 55-30 Sep 56, Contract AF 33(600)32054.
Order from OTS $2.75 PB 151 358

The Health Physics Group and the Medical Section of Convair's Personnel Department maintain a complete and continuous radiological health and monitoring program. The purpose of this program is to prevent damage to persons and property arising from the use of radioactive materials and nuclear machines. The program includes: Continuous evaluation of the levels of radioactivity in the environs. Routine and special physical examinations of all employees normally exposed to radiation. Routine and special measurements of the levels of radioactivity in controlled and uncontrolled areas. Routine and special monitoring of personnel working in controlled areas. The Health Physics Group maintains permanent records on: Radiation exposure of each monitored person. Receipt and disposition of radioactive sources. Disposal of radioactive waste material. Some aspects of sampling and monitoring. During the period covered by this report, the number of persons monitored by the Health Physics Group increased markedly. At the same time, many new areas of endeavor were opened. The result is that the task of Health Physics has expanded tremendously.

Nuclear Engineering and Power

Convair, Fort Worth, Tex.
METHODS AND PROCEDURES FOR RADIATION DAMAGE ANALYSIS. A SUPPLEMENT TO THE RADIATION EFFECTS HANDBOOK FOR AIRCRAFT DESIGNERS, by W. L. Fink. Rept. on Contract AF 33(600)32054. 27 June 57, 103p. 13 refs. MR-N-169; NARF-57-28T.
Order from OTS $2.50 PB 151 359

Methods are presented for normalizing the flux measurements from different reactor facilities to a common unit. This requires a microscopic determination of energy loss by gamma rays and neutrons. The determination of functional damage thresholds for material application is discussed. Experimental data is used to relate the change of physical properties under an irradiation environment. A statistical method is presented to aid in the analysis of experimental data. The "weakest link" concept is introduced to aid in defining problem areas, and to serve as a fairly good "first approximation" to the lifetimes for operating systems. A critical review of the method is presented to review the assumption employed.

Naval Engineering Experiment Station, Annapolis, Md.
INVESTIGATION OF DOUBLE TUBE SHEET DESIGN FOR CONDENSERS FOR NUCLEAR PROPELLED VESSELS, by M. R. Gross and H. C. Ellinghausen. 31 May 57, 13p. 2 refs. Research and Development rept. 040126; AD-135 136.
Order from LC mi$2.40, ph$3.30 PB 137 977

This report describes the effect of spacing and displacement on the expected life of double tube sheet condensers. A simple jig having a fixed and movable tube sheet connected by a single 70:30 or 90:10 copper-nickel condenser tube is used to study the various factors. Relationships between spacing, displacement, and cycles to failure are presented. It is concluded that a 3 in. spacing is necessary to fulfill the prescribed conditions of a 70:30 tube operating at a displacement of 1/16 in. for a minimum of 4,000 c.

North Carolina State Coll., Raleigh.
STUDY OF THE FISSION GASES FROM THE WATER BOILER REACTOR, by H. A. Lamonds. Rept. on Contract no. DA-36-034-ORD-1656. Oct 58, 115p. 30 refs.
Order from LC mi$6.00, ph$18.30 PB 139 553

The gamma-emitting activity in the off-gas of the Raleigh Reactor was studied. Curves are given showing the expected specific activities of the fission gases and their daughter products. The investigation produced substantial evidence of the existence of short-lived gamma-emitting isotopes not tabulated in the literature.

Radioactivity

Atomics International, Canoga Park, Calif.
RADIATION DAMAGE STUDIES IN COMPOUND SEMICONDUCTORS, by Fred H. Eisen, Paul W. Bickel, and Robert C. Bahleen. Rept. on Contract AF 33(616)3924. July 58, 41p. 14 refs. WADC Technical rept. 58-428; AD-155 783.
Order from OTS $1.25 PB 151 609

Measurements of electrical conductivity and of electron paramagnetic resonance (EPR) have been used in studying the damage produced by electron irradiation of several III-V semiconducting compounds. Studies of damage rate as a function of energy and damage recovery as a function of temperature and time have shown that displacements are produced in InSb at electron energies as low as 240 Kev. Two recovery stages, characterized by activation energies of 0.23 and 0.55 ev, were observed for recovery of the damage. The first stage follows first order kinetics, and preliminary information has been obtained about the kinetics of the second stage. An EPR spectrometer has been set up for observation of resonances at liquid helium temperatures. Present results are inconclusive but indicate the experimental approach necessary for the observation of resonances in irradiated III-V compounds.

Convair, Fort Worth, Tex.
Co^{60} GAMMA DOSE MEASUREMENTS INSIDE CYLINDRICAL SHIELDS, by D. G. Anderson. Rept. on Contract AF 33(600)32054. 16 Dec 57, 21p. 2 refs. NARF-57-60T; MR-N-172.
Order from LC mi$2.70, ph$4.80 PB 139 348

The transmission and attenuation of air and ground scattered gamma radiation through cylindrical crew shields has been investigated to provide information for the evaluation of calculational techniques. Gamma dose rates were measured along the centerline of two cylindrical crew shields of identical shapes, one half the size of the other. The larger cylinder corresponded in size to the engineered crew shield. Various sidewall rubber thicknesses, shadow shield angles, and source-detector separation distances were investigated for both cylinders. Measurements were made for air and ground scattered gamma radiation. The results of this investigation indicate that cavity size is not an important factor in crew shield penetration.

Convair, Fort Worth, Tex.
SHIELD SYSTEM OPTIMIZATION: GRADIENT NONLINEAR PROGRAMMING, by R. D. Sheffield. Rept. on Contract AF 33(600)32054. 30 Dec 57, 39p. 5 refs. NARF-57-62T; MR-N-186.
Order from LC mi$3.00, ph$6.30 PB 139 349

A procedure is developed for minimizing a nonlinear function of n variables subject to inequality constraints. Under suitable assumptions concerning convexity of the functions, a unique minimum is attainable by the method. The technique is applied to optimization of the total weight of a divided shield system subject to a prescribed dose rate level permitted in the crew compartment and to reactor leakage constraints. The procedure consists of two phases: a dose rate reduction phase followed by an isodose-rate weight reduction phase. Provision is made for satisfying the reactor leakage constraints which are expressed as linear inequalities. The process is iterative and provides a convergence criterion depending upon equality of certain weight-dose coefficient ratios

Radiation Effects Information Center, Battelle Memorial Inst., Columbus, Ohio.
EFFECT OF NUCLEAR RADIATION OF ELASTOMERIC AND PLASTIC MATERIALS, by N. J. Broadway, M. A. Youtz, and others. [Rept. on Contract AF 33(616)5171]. 31 May 58, 172p. 37 refs. REIC rept. no. 3; AD-149 552.
Order from LC mi$8.10, ph$27.30 PB 139 595

This report is the third of a series summarizing the state of the art on the effects of nuclear radiation on classes of materials, components, and systems of interest to designers and engineers concerned with nuclear-powered weapons systems. This report presents the state of the art of the effects of nuclear radiation on elastomeric and plastic materials from 1947 to the present. A brief description of the mechanism of radiation damage is followed by detailed presentation of data summarizing the radiation-effects information on various types of elastomers and plastics. Also, areas in which more research is needed are indicated. This report does not include information on the use of radiation for polymerization or vulcanization unless it has some bearing on effects of radiation on the finished polymer.

Sarah Mellon Scaife Radiation Lab., U. of Pittsburgh, Pa.
EFFECTS OF IONIZING RADIATION ON CERTAIN MATERIALS. Final summarizing rept. on Radiation Damage Study, Contract DA 18-108-cml-3429. Mar 54, 54p. 32 refs.
Order from LC mi$3.60, ph$9.30 PB 137 025

This report covers studies which have been made of the effects of radiation on silicone rubbers, silicone polymers, o-rings, refrigerants, chemical compounds, grease and oils in order to determine their usefulness after exposure to high intensity gamma ray flux.

School of Aviation Medicine, Randolph AFB, Tex.
RADIATION EFFECTS ON AQUEOUS SOLUTIONS OF S,2-AMINOETHYLISOTHIURONIUM SALTS, by Donald R. Anderson and Betty J. Joseph. Aug 58, 6p. 15 refs. Rept. 58-100.
Order from LC mi$1.80, ph$1.80 PB 137 877

Buffered aqueous solutions of AET showed marked sensitivity to ionizing radiation. Two methods of determining the concentration of sulfhydryl groups were used with comparable results. The destruction of sulfhydryl groups is directly dependent on radiation dose. The high yield suggests that a chain-type reaction may account for the radiation sensitivity. In deoxygenated samples, the radiation effect was decreased 47 percent; however, the effect was not altered with the addition of catalase or by saturation with oxygen. It is suggested that the protective activity of AET involves not only the sensitivity to radiation of the free sulfhydryl group, but also the capacity of the compound to couple with sensitive biologic molecules and shield them from radiation damage.

TRB, Inc., New York.
TRANSMISSION MATRIX AND MONTE CARLO GAMMA RAY PENETRATION, by Raphael Aronson. Final rept. on Contract AF 33(616)3616. Apr 58, 46p. 17 refs. WADC Technical rept. 58-383; AD-209 063.
Order from OTS $1.25 PB 151 658

Two Monte Carlo gamma ray penetration codes, one for plane and one for spherical geometries, are presented. Important histories and how to estimate their importance, according to position within the shield, are described qualitatively. Test results for the Monte Carlo buildup factors are listed. A transmission matrix method of computing transmission through infinite plane parallel shields, made up of several layers, is presented. The matrix for a multilayer shield is the product of the matrices for the component layers. Variational principles for the multiple scattering theory of penetration through slabs are discussed. The scope and purpose of WADC Technical Report 58-78 titled, "Cross Sections for Neutron Induced Reactions: A Review of Phenomenological Descriptions", by David M. Chase, Carl N. Klahr, and Aaron Timkin, are given. A procedure, which is adequate in a great many circumstances, to compute crudely the dose from gamma rays produced by inelastic neutron scattering in the shield is described.

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

Aero Medical Lab., Wright Air Development Center Wright-Patterson AFB, Ohio.
SEVERAL VARIABLES AFFECTING PERFORMANCE OF VENTILATED CLOTHING, by Paul Webb and James H. Veghte. Rept. for Mar-July 55 on Human Thermal Tolerance. Jan 56, 24p. 6 refs. WADC Technical rept. 56-43; AD-98 320.
Order from LC mi$3.00, ph$6.30 PB 137 303

An experimental program using the orthogonal square method was designed to determine the effect of altitude, clothing, temperature of the ventilating air, and the temperature of the ambient air on the use of ventilated clothing. A second series of experiments was carried out with a more detailed study of the clothing variable. An analysis of the results showed that as the barometric pressure was reduced, the protective effect of the ventilating system was increased. The effect of varying clothing was equalized over the range of variables selected, so that the over-all effect of clothing in these experiments was zero. The ventilating system proved effective with various flight clothing assemblies, therefore its use is not limited to the exposure suit assembly. Finally, a small flow of cool air was found to give better protection against heat than a larger flow of warmer air.

Air Crew Equipment Lab., Naval Air Material Center, Philadelphia, Pa.
EFFECTS OF ACTIVITY ON METABOLIC RATES OF SUBJECTS WEARING THE FULL PRESSURE SUIT, by P. R. Tiller and H. R. Greider. 12 July 57, 15p. 7 refs. NAMC-ACEL-345.
Order from LC mi$2.40, ph$3.30 PB 137 371

With the advent of the full pressure suit, the problems of increased work load on the pilot's metabolic rate becomes important. A F7U mock-up was used wherein a simple pilot's task was performed, which consisted of pushing the stick and two throttles forward and backwards every 10 seconds for six minutes. Metabolic rates were obtained while subjects were wearing the full pressure suit pressurized to 2 p. s. i. and the full pressure suit in the unpressurized condition; the rates obtained were compared to those of subjects wearing summer flight suits. The results revealed that there were no statistically significant difference between the subjects' metabolic rate when wearing the pressure suit pressurized and when wearing the pressure suit unpressurized or the summer flight suit. It is recommended that more extensive studies for longer periods of time be carried out in a flight simulator representative of the type aircraft that requires the use of a pressure suit. In this way, the interaction between such stress conditions as emergency, work task, and suit pressurization could be studied.

Department of Commerce, Washington, D. C.
MEN'S CIRCULAR FLAT- AND RIB-KNIT RAYON UNDERWEAR. 2d ed. 5 Dec 50, 16p. Commercial Standard 148-50, supersedes CS-148-48.
Order from LC mi$2. 40, ph$3. 30 PB 137 581

Department of Commerce, Washington, D. C.
WOMEN'S CIRCULAR FLAT-KNIT RAYON UNDERWEAR SIZES (INCLUDING NIGHTGOWNS AND PAJAMAS). 24 Dec 52, 17p. Commercial Standard CS189-52.
Order from LC mi$2. 40, ph$3. 30 PB 137 582

Marine Corps Development Center, Quantico, Va.
TRAILER, 2-WHEEL, SHOE REPAIR; TRAILER, 2-WHEEL, CLOTHING REPAIR; AND TRAILER, 2-WHEEL, TEXTILE REPAIR, by L. N. Hall and H. C. Cooper. Test rept. 26 June 56, 53p. MCEB Proj. no. T-914.
Order from LC mi$3. 60, ph$9. 30 PB 136 165

Naval Research Lab., Washington, D. C.
SURFACE ACTIVITY OF FLUORINATED ORGANIC COMPOUNDS AT ORGANIC-LIQUID/AIR INTERFACES. PART I: SURFACE TENSION, PARACHOR, AND STABILITY, by N. Lynn Jarvis and W. A. Zisman. Interim rept. 20 Jan 59, 14p. 24 refs. NRL rept. 5244.
Order from LC mi$2.40, ph$3.30 PB 136 332

A variety of fluorinated compounds which are liquids at 20°C were investigated for surface activity at organic-liquid/air interfaces. The majority of the compounds had one or more fluorocarbon chains, of varying molecular weights, attached to the hydrocarbon portion of the molecule by an ester, ether, or silicate linkage. The surface activity of these fluorinated compounds on a given substrate can be determined to a first approximation by their spreading behavior on that substrate. Their ability to spread upon the following organic liquids was investigated: double end-blocked polypropylene oxide, n-hexadecane, mineral oil, bis(2-ethylhexyl)sebacate, squalene, nitromethane, 1-2-dibromoethyl benzene, 1-methylnapthalene, tricresyl phosphate, phenoxy bis(o-chlorophenoxy)-phosphate, propylene carbonate, and trichlorodiphenyl. Spreadability was thus observed on liquids having a wide range of surface tensions and surface compositions.

Naval Supply Research and Development Facility, Bayonne, N. J.
DEVELOPMENT OF INTERNALLY SUPPORTED VINYL FILMS FOR USE IN IMMERSION SUITS: PHASE II. EVALUATION OF SEAM STRUCTURE AND PHYSICAL PROPERTIES OF HEAT SEALED SEAMS, by Jack Naimer. Rept. on Shipboard Immersion and Rescue Clothing. 15 Oct 58, 14p. 2 refs. Research and Development rept. no. 29.
Order from LC mi$2. 40, ph$3. 30 PB 137 935

An evaluation was made of the dielectric heat sealing properties of vinyl laminated materials described in the Phase I report of this program. A subsidiary investigation was conducted to determine the optimum width of seal and the best seam type to be used in the manufacture of prototype immersion suits.

Occidental Coll., Los Angeles, Calif.
"SECOND SKIN" PROTECTION AGAINST LOW TEMPERATURE EXPOSURE, by L. Reed Brantley, John M. Dunham, and Herbert Meyer. Final rept. for 21 Nov 56-31 Jan 58 on Contract DA 19-129-qm-795. 1958, 101p. 4 refs.
Order from LC mi$5. 70, ph$16. 80 PB 135 317

Vinyl plastisols with good viscosity stability have been developed. Accelerators are described with which these plastisols can be fluxed, at temperatures feasible for the skin, to form either dense or foamed coatings with satisfactory physical properties including flexibility at -65°F. New silicone rubber coatings were found which cure at room temperature. These coatings cured in either foamed or dense form show no loss of elastomeric properties when cooled to -65°F. A two layer system is described consisting of a soft, resilient layer of plastisol or silicone rubber foamed on the skin for thermal insulation and thin dense covering layer of plastisol or silicone rubber for abrasion resistance.

Quartermaster Research and Development [Center] Natick, Mass.
DEVELOPMENT OF FIELD SLEEPING GEAR, by Jan H. Vanderbie and Daniel F. Rene'. Aug 56, 34p. 13 refs. Tentage & Equipage Series rept. no. 13.
Order from LC mi$3.00, ph$6.30 PB 136 115

This report presents the results of a series of observations on the performance of standard and experimental sleeping gear. It also contains an analysis of the functional features necessary for adequate field sleeping gear. The most important limiting factors in the design of adequate sleeping gear appear to be weight and bulk. The findings of this study suggest that a redistribution of the effective insula-

tion provided by standard sleeping bag ensembles will increase the protection afforded without increasing the load of the soldier.

PHYSICS

Acoustics

Naval Research Lab., Washington, D. C.
INTENSITY DISCRIMINATION FOR NARROW BANDWIDTHS OF NOISE AT VARIOUS PULSE LENGTHS, by R. M. Michaels. Oct 58, 31p. 14 refs. NRL rept. 5188.
Order from LC mi$3.00, ph$6.30 PB 134 206

Upon the assumption that the auditory system acts as an envelope detector, a series of hypotheses were stated predicting how intensity discrimination would be influenced by the variations in the stimulus envelope. The results indicate that discrimination was the same for stimuli whose envelopes are smoothed by the auditory system despite differences in frequency spectrum. For stimuli whose envelope fluctuations occur at a rate less than the integrating time of the auditory system, discrimination is degraded, increasingly so as bandwidth is reduced. However, differences in discrimination among bandwidths were eliminated when pulse duration was reduced sufficiently to preclude envelope variations. The results, in general, indicate that the envelope detector model is a reasonable description of auditory discrimination.

Soundrive Engine Co., Los Angeles, Calif.
STUDIES OF VERY HIGH AMPLITUDE SOUND, by O. B. Wilson, Jr. and David Alan Bies. Technical rept. on Contract AF 18(600)495, Apr 55, 23p. 8 refs. Rept. no. 82; OSR TR-55-10; AD-72 433.
Order from LC mi$2.70, ph$4.80 PB 137 707

Electricity and Magnetism

Army Signal Research and Development Lab., Fort Monmouth, N. J.
SOLUTIONS OF CONTOUR-SHEAR MODE OF SQUARE PLATES OF ANISOTROPIC MATERIAL, by R. Bechmann. 30 Apr 58, 16p. 12 refs. Engineering rept. no. E-1219.
Order from LC mi$2.40, ph$3.30 PB 136 584

The various solutions for the frequency of fundamental contour-shear mode of square plates of anisotropic material have been considered and compared with the measured values for the frequencies of various plates made from quartz and water soluble piezoelectric crystals. The higher order modes of contour-shear modes of square plates have been considered. Particularly the ET- and FT-Cuts of quartz as second order vibration, giving a zero temperature coefficient of frequency, have been theoretically considered for the first time.

Colorado A. and M. Coll., Fort Collins.
MOUNTING TECHNIQUES FOR IMPROVED HEAT DISSIPATION IN QUARTZ CRYSTAL UNITS, by Virgil E. Bottom, Robert G. Thompson and others. Final rept. 29 Feb 51-29 Feb 52, on Contract DA 36-039-sc-5485. 55p. 20 refs. ATI-163 820.
Order from LC mi$3.60, ph$9.30 PB 136 205

In a quartz element practically all the heat is removed by conduction through the surrounding gas. With helium in the holder, temperature rises are about one-fourth as great as those experienced when the holder is filled with air or nitrogen. Frequency perturbations are directly proportional to the square of the piezoelectric current and inversely proportional to the area of the vibrating portion of the quartz plate. The amplitude-frequency effect is due to the mechanical stress resulting from the thermal gradient in the quartz plate.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
PIEZOELECTRIC ELEMENTS AS HIGH-POWER ELECTRICAL ENERGY SOURCES, by L. William Doremus and Kenneth D. George. Sep 58, 26p. 2 refs Technical rept. 2562.
Order from LC mi$2.70, ph$4.80 PB 136 581

An analysis is made of the use of piezoelectric elements (piezoids) to generate high-power electrical pulses when directly connected to resistive electrical loads. Relations are developed among the general system parameters. In order to deliver a given amount of energy the piezoid element must have a certain minimum volume. The maximum energy transfer occurs when the time T taken to apply the load is equal to or greater than 20 RC, where RC is the electrical time constant of the electric circuit. The expression for maximum electric field strength is derived, and may be used to determine whether the given material has sufficient dielectric strength to avoid electrical breakdown.

Levinthal Electronic Products, Inc., Palo Alto, Calif.
PRODUCTION OF IMPULSE MAGNETIC FIELDS IN THE MILLIMICROSECOND TIME DOMAIN, by Harry G. Heard. Technical rept. no. 1 on Contract AF 30(635)2813. 24 May 55, 112p. 150 refs. Rept. no. 104; RADC TN-57-192; AD-114 484.
Order from LC mi$6.00, ph$18.30 PB 135 256

A study has been made of the problems associated with the use of a switching device in conjunction with an appropriate pulser for the production of 3,000 gauss fields in a time of the order of 2×10^{-10} sec. It is shown than an atmospheric pulse sharpening gap and a low impedance transmission line represent the optimum configuration for pulsed operation. An optimum coil design will be that of a deep single turn solenoid which terminates the transmission line of the pulser. This pulser combination may be expected

to operate at not more than 100 pps. It should produce an average power output from the ferrite source of about 1 watt. The low pulse rate is associated with the switching of 52 megawatts of peak power. Electrode erosion at this power level will be of the order of 10 micrograms per pulse. Because the pulse sharpening gap is critical as to electrode spacing, frequent readjustment of the gap will be required. Non-linear transmission lines are treated in brief as they may be useful in reducing the peak current (2400 amperes) which the switch must transmit. The theory of pulse sharpening, electron removal in decaying plasmas and effects of pulse amplitude and duration on the deionization time are treated in detail as a basis for extrapolating existing knowledge to the rather severe requirements of the switch. A review of switching devices is included.

South Carolina U., Columbus.
STUDY OF POSITRON LIFETIMES IN SOLIDS, by A. P. French and A. R. Lowrey. Final rept. on Contract AF 49(638)74. Apr 58, 56p. 20 refs. AFOSR TR-58-63; AD-158 241.
Order from LC mi$3.60, ph$9.30 PB 136 181

The purpose of this work was to study the effect of an internal electric field on the mean lifetime of positrons in a ferroelectric material. The internal electric field can effectively be "turned on or off" by raising or lowering the samples' temperature above or below the Curie temperature. A fast coincidence circuit (resolving time approximately 3 millimicroseconds) was assembled. The components not commercially available were constructed and the equipment was calibrated. Decay curves were run for several materials, some of which have been previously studied, (aluminum, teflon, polyethylene, and plexiglas). The results compare favorably with measurements obtained by others. The decay curve was run for Rochelle Salt, a ferroelectric crystal with an internal field of approximately 800 esu between the temperatures 255°K and 297°K. Several measurements were taken with the sample above the critical temperature of 297°K, and the lifetime was found to consist of one component, τ_1, $(5.25 \pm 0.25) \cdot 10^{-10}$ sec.

Springfield Armory, Mass.
MAGNETIC METHOD OF MEASURING DISPLACEMENT, by H. P. Hatch and C. N. Julian. 19 Sep 58, 14p. SA-TR20-6001.
Order from LC mi$2.40, ph$3.30 PB 136 583

This report describes an investigation to determine the feasibility of applying magnetic principles to the measurement of displacement of magnetic components in vibrating systems. An experimental fixture was designed and fabricated. Procedure is presented. Results indicate feasibility of measuring displacement of a magnetic structure by means of the effect of the magnetic structure upon the flux distribution in a magnetic circuit.

Electronics

Air Force Cambridge Research Center, Bedford, Mass.
THE EFFECT OF LOG-NORMAL FADING ON FSK; A VERY SIMPLE MODEL, by John Mott-Smith. July 58, 17p. 2 refs. AFCRC-TR-58-170; AD-160 792.
Order from LC mi$2.40, ph$3.30 PB 137 065

The fading model assumed is that the signal-to-noise ratio S/N for each binary transmission is an independent sample from a log-normal distribution. The error rate dependence on S/N is chosen to correspond to baud synchronous envelope detection of signals in white gaussian noise, which includes frequency-shift keying. The resulting digit error probabilities are calculated by numerical integration. The calculations indicate that during relatively good hf transmission periods, when log-normal fading may be a good model, the depreciation is slight even for very stringent reliability requirements. For more violent fading, however, the depreciation increases sharply.

Diamond Ordnance Fuze Labs., Washington, D. C.
METHOD OF COMPUTING THE CHARACTERISTICS OF A SYMMETRIC SPHERICAL ANTENNA, by Julius Herman. 1 Aug 57, 19p. 3 refs. TR-496.
Order from LC mi$2.40, ph$3.30 PB 137 402

Equations suitable for numerical calculation of the characteristics of a symmetric spherical antenna have been detailed using the basic theory developed by S. A. Schelkunoff for a biconical antenna. Equations for ohmic loss in the antenna region and over the hemispherical caps have been developed. Calculations of input impedance, radiated power, and radiation efficiency for an electrically small antenna have been made, and the results shown in graphical form.

Northwestern U., Evanston, Ill.
EXCITATION OF SHORT INFRARED PULSES WITH HIGH REPETITION RATE BY ELECTRON BOMBARDMENT OF CUPROUS OXIDE, by Rudolf Frerichs and Frank L. Weichman. Final rept. on Contract Nonr-1228(04). Sep 57, 20p. 8 refs.
Order from LC mi$2.40, ph$3.30 PB 135 743

The infrared emission of Cu_2O under electron-bombardment was investigated. Lamps containing an electron-bombarded Cu_2O target emit a single band between 0.8 and 1.4μ. They can be very accurately pulsed with the help of a built in grid. The efficiency at 6500 volts is about 4 to 5% of the electrical input. With improved cooling of the target, such lamps should form a powerful source for repetitive microsecond pulses of the near infrared spectral region which can be observed with photoemissive tubes and image converters.

[Research Inst.] U. of Michigan, Ypsilanti.
MASER ACTION IN RUBY, by G. Makhov, C. Kikuchi and others. Rept. on Proj. Michigan, Contract AF 49(638)68. June 58, 8p. 5 refs. 2616-1-T; AFOSR [TN] 58-288; AD-154 192.
Order from LC mi$1.80, ph$1.80 PB 135 368

In an endeavor to find paramagnetic materials suitable for maser applications, the electron-spin resonance properties of ruby (Al_2O_3:Cr) were investigated. Evidence of oscillations and amplifications was obtained.

Stanford Electronics Labs., Stanford U., Calif.
ELECTRON DYNAMICS, by O. Buneman. Rept. on Contract AF 33(600)27784. 18 Aug 58, 25p. 49 refs. Technical rept. no. 385-3.
Order from LC mi$2.70, ph$4.80 PB 136 588

The object of this report is to demonstrate the value of the "hydrodynamical" approach to electron dynamics (as against the individual-particle approach) and to furnish a hydrodynamical "unified electron tube theory." By "tube" is meant any system in which the unperturbed electron beam or cloud, and the electromagnetic fields, have cylindrical or planar symmetry. This definition covers a large variety of devices. Because of the hydrodynamical approach, the theory can cope with solid beams, not only filaments or sheets of electrons. Also, strong coupling is covered by the theory. Qualitatively, the generative properties of electron clouds or beams are readily demonstrated, while qualitative analysis is reduced to the integrand of a single first-order differential equation for the electron admittance across the beam or cloud.

Stanford Electronics Labs., Stanford U., Calif.
HOW TO DISTINGUISH BETWEEN ATTENUATING AND AMPLIFYING WAVES, by O. Buneman. Rept. on Contract AF 33(600)27784. 11 Aug 58, 31p. 14 refs. Technical rept. no. 385-2.
Order from LC mi$3.00, ph$6.30 PB 136 587

In the theoretical analysis of traveling-wave tubes disturbances of the form $\exp(j\omega t - j\beta z)$ represent growing waves when, for real frequency ω, the associated propagation constant β has a positive imaginary part. The connection between β and ω is given by the dispersion equation which results from equating to zero the sum of two admittances: that looking transversely into the slow wave structure and that looking transversely into the beam, from some intermediate level. However, only when the rate of change of this admittance sum with β has a negative imaginary part can the growing wave be used for amplification, i.e., for feeding power into a termination of the tube.

Stanford Electronics Labs., Stanford U., Calif.
INSTABILITY, OR MICROWAVE AMPLIFICATION, IN HIGH-CURRENT DISCHARGES, by O. Buneman. Rept. on Contract AF 33(600)22784. 25 Aug 58, 13p. 15 refs. Technical rept. no. 385-4.
Order from LC mi$2.40, ph$3.30 PB 136 589

The two-stream amplification mechanism is operative between electron and ions in relative motion. The e-folding time of fluctuations can become as short as $18A^{1/3}/\omega_p$ where A is the ionic mass number, ω_p the electron plasma (circular) frequency. The wavelength of these most rapidly growing fluctuations is the distance traveled in mutual motion during one electron-plasma period. Growth of r-f instabilities takes over from close ion-electron collisions in fully ionized plasmas for damping out any appreciable mutual motion, leading to an effective conductivity $K\epsilon\omega_p$ where K is of the order 10 - 100 for the lighter ions.

Molecular Physics and Spectroscopy

Kansas State Coll., Manhattan.
RESEARCH DIRECTED TOWARDS THE EXPERIMENTAL STUDY OF THE INFRARED BANDS OF THE OXIDES OF NITROGEN, by I. C. Hisatsune. Final rept. on Contract AF 19(604)2255. [1958] 17p. AFCRC TR-58-237; AD-152 558.
Order from LC mi$2.40, ph$3.30 PB 135 880

Techniques of handling the nitrogen oxides and the construction of apparatus such as low-temperature cells for the infrared studies of these compounds are described. We have made a preliminary study of the infrared absorption bands of solid dinitrogen trioxide in the neighborhood of the reported phase transition temperature of -125°C. Frequencies of absorption bands which appeared between 2 and 25 micron wavelength and which have been tentatively identified with N_2O_3 are reported.

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
ANALYTICAL APPLICATIONS OF FAR INFRARED SPECTRA. II. SPECTRA-STRUCTURE CORRELATIONS FOR ALIPHATIC AND AROMATIC HYDROCARBONS IN THE CESIUM BROMIDE REGION, by Freeman F. Bentley and Eugene F. Wolfarth. Rept. for Nov 56-Dec 57, on Materials Analysis and Evaluation Techniques. May 58 [55]p. 51 refs. WADC Technical rept. 58-198; AD-155 566.
Order from OTS $1.50 PB 151 677

The infrared absorption spectra of some 400 aliphatic and aromatic hydrocarbons have been investigated from 15 to 35 microns and the characteristic absorption frequencies incorporated into spectra-structure correlation charts. The classes of compounds studied were alkanes, alkenes, cyclopropanes, cyclobutanes, cyclopentanes, cyclohexanes, substituted benzenes, naphthalenes and biphenyls. The skeletal bending frequencies of the alkanes and alkenes and the nonplanar bending frequencies of cycloalkanes and aromatics are the most useful. The wavelength and intensity of the out-of-plane ring frequencies of aromatic molecules give some indication of the nature of the substituents. Typical infrared spectra of the hydrocarbons are presented.

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
ANALYTICAL APPLICATIONS OF FAR INFRARED SPECTRA. II. SPECTRA-STRUCTURE CORRELATIONS FOR ALIPHATIC AND AROMATIC HYDROCARBONS IN THE CESIUM BROMIDE REGION, by Freeman F. Bentley and Eugene F. Wolfarth. Rept. for Nov 56-Dec 57, on Materials Analysis and Evaluation Techniques. Dec 58 [57]p. 52 refs. WADC Technical rept. 58-198, suppl. 1; AD-207 796.
Order from OTS $1.50 PB 151 677S

The infrared absorption spectra of some 400 aliphatic and aromatic hydrocarbons have been investigated from 15 to 35 microns and the characteristic absorption frequencies incorporated into spectra-structure correlation charts. The classes of compounds studied were alkanes, alkenes, cyclopropanes, cyclopentanes, cyclohexanes, substituted benzenes, naphthalenes, and biphenyls. The skeletal bending frequencies of the alkanes and alkenes and the nonplanar bending frequencies of the aromatic hydrocarbons are the most useful for qualitative analysis in this region.

Naval Research Lab., U. of Wisconsin, Madison.
COLLISION PROCESSES INVOLVING ATOMS IN EITHER THEIR GROUND OR EXCITED STATES, by Joseph O. Hirschfelder. Rept. on Contract N7onr-285(11). 1 Oct 57, 13p. 9 refs. WIS-ONR-26.
Order from LC mi$2.40, ph$3.30 PB 136 463

Technical Operations, Inc., Burlington, Mass.
EFFECT OF SOLVENT AND SUBSTITUENTS ON THE ABSORPTION SPECTRUM OF QUINONE, by James E. LuValle, Gershon M. Goldberg, and Joan Des Roches. Technical note on Contract AF 18(600)371. June 58, 15p. 5 refs. Rept. no. TOI 58-18; AFOSR TN-58-478; AD-158 289
Order from LC mi$2.40, ph$3.30 PB 135 408

A linear correlation exists between Δ, the difference in molecular affinities of the quinone and the solvent, and the energy of the absorption band. In general, the frequency of the absorption band decreases as the value of Δ increases. The ionization potentials of the donor molecules are almost identical with donor molecule reactivity. This will be true whenever the electron affinity is small. The data show that chloranil forms 1:1 molecular complexes with both triethyl and triphenylamine. The hexamethylbenzene chloranil complex was isolated and the infrared absorption spectrum obtained. The data lend strong support to the hypothesis that quinones in general tend to form complexes with Lewis bases. The linear relationships between molecular affinity and E_{λ} and the molecular reactivity and E_{λ} support the idea that the differential molecular affinity and the differential molecular reactivity are related to the interaction energy of acceptor and base.

Optics

Ohio State U. Research Foundation, Columbus.
GLASS TO TRANSMIT INFRARED RADIATIONS, by H. H. Blau. Rept. no. 14 (Final) 30 Nov 54 on Contract DA 44-009-eng-658. 20 June 56, 67p. AD-112 568.
Order from LC mi$3.90, ph$10.80 PB 135 715

This work resulted in the basic means for producing outstanding Doublet filters incorporating an absorptance band centering about 0.88 micron and derived from the presence of the oxides of neodymium and a filter cutting off at 1.5 microns and transmitting rather well out to 6.3 microns. In the field of infrared windows, a new series of tellurate glasses was developed. Survey work was carried on to explore sulphides, selenides and tellurides as windows.

Rochester U., N. Y.
EVAPORATION OF THIN FILMS, by Theodore Dunham, Jr. Rept. no. 95 on Contract OEMsr-160. 1 Mar 45, declassified 4 Oct 54, 102p. OSRD rept. no 4789; ATI-23 656.
Order from LC mi$5.70, ph$16.80 PB 139 530

The University of Rochester has developed methods for applying low-reflecting films to glass surfaces in optical instruments. The present report describes the development of methods for applying high-efficiency high-reflecting films, multiple layer filters, and polarizing beam splitters.

Wayne State U., Detroit, Mich.
EXPERIMENTAL INVESTIGATIONS ON THE LIGHT SCATTERING OF COLLOIDAL SPHERES. III. THE SPECIFIC SCATTERING AT 90°, by Richard Tabibian and Wilfried Heller. Technical rept. no. 24 on Contract Nonr-736(00). 16 June 57, 32p. 8 refs. AD-134 708.
Order from LC mi$3.00, ph$6.30 PB 135 273

An experimental arrangement for precise light scattering measurements from colloidal solutions at an angle of 90° with respect to the primary beam is described. The results obtained from sixteen polystyrene and polyvinyltoluene latices with particle diameters ranging from 45 to 824 millimicrons provide an additional verification of the Mie theory of light scattering. The effect of multiple scattering and of the solid angle are studied and methods for excluding their interference with particle size determinations are described which should be also for molecular weight determinations in polymer solutions. The problem of the instrument constant is analyzed and a principle is pointed out whereby quasiabsolute lateral scattering data can be obtained by suitable internal compensation within a properly constructed apparatus. The advantages and disadvantages of lateral measurements as compared to turbidity measurements are pointed out.

Battelle Memorial Inst., Columbus, Ohio.
HALL AND TRANSVERSE MAGNETORESISTANCE EFFECTS FOR WARPED BANDS AND MIXED SCATTERING, by A. C. Beer and R. K. Willardson. Technical note no. 1 on Contract AF 18(603)39. 30 Dec 57, 33p. 30 refs. AFOSR TN-58-98; AD-148 147.
Order from LC mi$3.00, ph$6.30 PB 136 193

Evaluation of the transport integrals for warped bands by a method developed by W. McClure (Phys. Rev. 101:1642, 1956) is made for relaxation times determined by mixed scattering from acoustic phonons and ionized impurities. The analysis involves third and fifth harmonics and coefficients whose values depend on the shape of the energy surface. Hall and transverse magnetoresistance coefficients are calculated for parameters characteristic of the degenerated valence bands in Ge and Si, as obtained from cyclotron resonance data. For Ge, results are consistent with observation in regard to a density of states ratio for fast and slow holes of about 4% and in the occurrence of fine structure, especially a minimum in the Hall coefficient between 1000 and 2000 gauss at 80°K, depending on the impurity content. With parameters representative of Si, substantially different behavior is predicted in line with experiment. The Hall characteristics indicate smaller effects due to the warping than are found in Ge. Orientation effects are not examined. The field dependence of the Hall coefficient at 196°K and 300°K could not be interpreted in terms of the model.

Convair, Fort Worth, Tex.
EFFECT OF NEUTRON IRRADIATION ON THE CRITICAL SHEAR STRESS OF A METAL SINGLE CRYSTAL, by C. E. Morgan. Rept. on Contract AF 33(600)32054. 20 Mar 58, 62p. 28 refs. MR-N-192; NARF-58-9T.
Order from LC mi$3.90, ph$10.80 PB 139 023

A mechanism is postulated to account for the change in the critical shear stress of a metal single crystal upon irradiation. This mechanism is based on a lattice defect consisting of interlocking dislocation rings. The critical shear stress varies as the cube root of the integrated neutron flux. Other radiation-hardening mechanisms (viz., interaction of slip dislocations with interstitials and vacancies, formation of stacking faults or agglomerations of interstitials and vacancies and formation of jogs on dislocations) are discussed. The critical shear stress of copper was calculated for neutron doses up to 2×10^{19} nvt. The calculated values agree quite well with available experimental data on irradiated high-purity copper crystals. Appendix includes a glossary of scientific terms used in developing the shear stress theory.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH: GROUP 35, PHYSICS; GROUP 37, SPECTROSCOPY; GROUP 310, CHEMISTRY AND METALLURGY, by Benjamin Lax. Quarterly progress rept. 1 Apr-30 June 57, on Contract AF 19(122)-458. 1 Aug 57, 78p. 50 refs. AD-151 261.
Order from LC mi$4.50, ph$12.30 PB 139 203

Semiconductor device design: Outdiffused base n-p-n transistor, fast-response photodiode, an application of switching elements utilizing impact ionization of impurities, floating-junction devices, device chemistry, and technique development. Chemistry: Germanium dissolution studies, kinetics of the reaction of germanium with water, dissolution potential of germanium in water, adsorption of ions on metal surfaces from liquid media, anodic dissolution germanium in aqueous solutions, thermal regeneration of oxygenated germanium surfaces, chemical studies on indium antimonide, and characteristics of the spark discharges used in spectrochemical analysis. Metallurgy of materials: X-ray rocking-curve study on copper single crystals, forbidden X-ray reflections, deformation of single-crystal germanium, InSb crystal growing, and stacking faults in germanium and indium antimonide. Band structure of solids: Oscillatory magnetoabsorption of the direct transition in germanium, far-IR cyclotron resonance and reflection, high pressure and optical properties of semiconductors, dc magnet program, galvanometric effects in silicon carbide, on the anomalous skin effect with superimposed magnetic field, plasma oscillations for obliquely oriented magnetic field, and plasma oscillations in a many-valley semiconductor. Microwave and ferrite applications: Ferrite applications and millimeter wave program. Microwave and magnetic properties of matter: Solid state maser, ferromagnetic thin films, ferromagnetic resonance in yttrium iron garnet, magnetization processes in single-crystal cobalt ferrite, pulsed-field antiferromagnetic resonance, pulsed-field exchange resonance, and VHF resonant circuit.

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
ELECTRONIC PROPERTIES OF SEMI-CONDUCTOR MATERIALS, by Jurij Maczuk and B. P. Fabricand. Quarterly progress rept. no. 1, 1 Mar-30 June 57, on Study of Lifetime and Injection Ratio Characteristics of Minority Carriers on Silicon Single Crystals, Contract DA 36-039-sc-72406. 30 June 57, 31p. 11 refs. Moore School rept. no. 57-19.
Order from LC mi$3.00, ph$6.30 PB 136 089

The temperature dependences of lifetime, injection ratio, and resistivity in p-type silicon crystals were measured by the use of the pulse decay method. At high temperature the dependence of lifetime and injection ratio on emitter current and sweeping field is identical with that which one observes at room temperature.

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
ELECTRONIC PROPERTIES OF SEMI-CONDUCTOR MATERIALS, by Jurij Maczuk and B. P. Fabricand. Quarterly progress rept. no. 2, 1 June-30 Sep 57, on Study of Lifetime and Injection Ratio Characteristics of Minority Carriers on Silicon Single Crystals, Contract DA 36-039-sc-72406. 30 Sep 57, 23p. 2 refs. Moore School rept. no. 58-07.
Order from LC mi$2.70, ph$4.80 PB 136 088

Results are obtained which show the dependence of surface state energy levels under a point contact on temperature, injecting voltage, and sweeping field in a p-type 250 ohm-cm crystal. Time constants for the filling and emptying of surface states for different voltages are also found. These results are obtained by observing the carrier disturbances under a point contact by a pulse method previously described. A theory of the behavior observed is presented.

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
ELECTRONIC PROPERTIES OF SEMI-CONDUCTOR MATERIALS, by Jurij Maczuk and B. P. Fabricand. Quarterly progress rept. no. 3, 1 Sep-30 Nov 57, on Study of Lifetime and Injection Ratio Characteristics of Minority Carriers on Silicon Single Crystals, Contract DA 36-039-sc-72406. 31 Dec 57, 27p. 9 refs. Moore School rept. no. 58-14.
Order from LC mi$2.70, ph$4.80 PB 136 087

The contact resistance of rhodium-silicon metallic contacts varies asymmetrically with cooling of the crystal below room temperature.

National Bureau of Standards, Washington, D. C.
PLASTIC DEFORMATION OF CERAMIC-OXIDE SINGLE CRYSTALS, by John B. Wachtman, Jr. and Laurel H. Maxwell. Rept. for 30 June 53-15 Nov 54, on Contract AF 33(038)51-4056. Nov 54, 72p. 21 refs. WADC Technical rept. 53-265, Suppl. 1; AD-65 963.
Order from LC mi$4.50, ph$12.30 PB 139 626

"The modulus of rupture of flame-polished synthetic sapphire rods of 45° orientation falls from about 5,000 kg/cm^2 (71,000 lb/in.^{2}) at 30°C to about 3,700 kg/cm^2 (52,500 lb/in.^{2}) at 300°C, rises rapidly above 800° to a maximum of about 6,200 kg/cm^2 (88,000 lb/in.^{2}) at 1000°C, and drops off slightly at 1100°C. The creep yield stress over the range 900°C to 1400°C falls smoothly from about 780 kg/cm^2 (11,100 lb/in.^{2}) to 130 kg/cm^2 (1,850 lb/in.^{2}). Synthetic ruby has a creep yield stress of about 300 kg/cm^2 (4,260 lb/in.^{2}) at 1300°C, indicating that chromia has a hardening effect. Over the temperature range 900°C to 1500°C, sapphire deforms by slip on the (0001) plane in the [1$\bar{2}$10] direction. In periclase, plastic deformation begins at about 1100°C with slip taking place on the (111) plane, the (110) plane, and the (100) plane with the [1$\bar{1}$0] slip direction. In rutile, plastic deformation begins at about 600°C on the (011) plane, the (201) plane, and possibly the (001) plane. Electron micrographs of rutile deformed at 1000°C indicate slip line heights of 200 to 900 Angstroms. Electrical resistivity of sapphire was measured over the temperature range 500 to 1000°C. After sapphire was plastically deformed, the resistivity was found to be higher over the entire temperature range. Subsequent heating to 1800°C reduces the resistivity."

National Advisory Committee for Aeronautics, Washington, D. C.
THE THEORY OF DIFFUSION IN STRAINED SYSTEMS, by Louis A. Girifalco and Hubert H. Grimes. Sep 58. 49p. 26 refs.
Order from NASA NACA TN-4408

A general theory of solid-state diffusion in strained systems is developed on a molecular-kinetic basis. The theory predicts that for simple strains the diffusion coefficient is an exponential function of the lattice parameter and that the rate of change of the diffusion coefficient with strain is linearly related to the interatomic forces. It has also been shown that for plastic flow the diffusion coefficient is a linear function of strain rate. All these conclusions are confirmed by the data available in the literature.

New York Coll. of Ceramics, Alfred U.
SEMICONDUCTING MATERIALS. Annual rept. for Dec 56-Nov 57 on Contract Nonr-1503(01). 1957, 56p. 13 refs.
Order from LC mi$3.60, ph$9.30 PB 136 748

Contents:
Preparation of single crystals
- Mercury selenide
- Mercury telluride
- Zinc telluride
- Arsenides and phosphides

D. C. measurements on CdTe crystals
- Measurement technique
- Resistance time dependence
- Hall measurements
- Unpolarized temperature memory
- New apparatus

Photoconductivity of CdTe crystals
- Impurity samples
- Pure samples
- Interpretation of measurements
- Photoconductivity as a function of light intensity

Pennsylvania State U., Coll. of Mineral Industries, University Park.
CRYSTAL CHEMISTRY STUDIES, by Rustum Roy, A. Gentile and others. Final rept. for 1 Oct 56-1 Oct 57, on Contract DA 36-039-sc-71214. [1958] [269]p. 103 refs. AD-152 890.
Order from LC mi$11.10, ep$41.10 PB 139 431

Progress work is reported in the body of the report while an overall view of achievements during the contract life is given in the Section on Publications and Reports, and the most recent of the detailed technical reports are attached as Appendices.

Virginia Inst. for Scientific Research, Richmond.
ANISOTROPIC PHOTOGRAPHIC AND RELATED PROPERTIES OF MONOCRYSTALLINE SILVER CHLORIDE. II, by Henry Leidheiser, Jr., Forrest A. Hettinger, and W. Jack Gregory. Rept. on Contract AF 33(616)323. July 57, 54p. 18 refs. WADC Technical rept. 57-264; AD-118 253.
Order from LC mi$3.60, ph$9.30 PB 136 178

Transmission spectrographic studies were made on single crystal discs of silver chloride which had been polished and etched. The spectral region between 4000 and 9000 A. was studied. The highest transmissions were obtained on crystals which were heated in chlorine at 200-300°C., subjected to vacuum treatment, and lightly etched. The transmission at all wavelengths increased and the minimum moved to shorter wavelengths as the sample was aged.

Wayne State U., Detroit, Mich.
PREPARATION OF THIN SINGLE-CRYSTAL SEMICONDUCTOR FILMS BY PHOTOELECTRIC ETCHING, by W. A. Albers, Jr. and J. E. Thomas, Jr. Technical rept. no. 1 on Contract AF 49(638)158. 22 July 58, 31p. 9 refs. AFOSR TN 58-643; AD-162 175.
Order from LC mi$3.00, ph$6.30 PB 138 981

Theoretical Physics

Cornell U., Ithaca, N. Y.
NOTES ON THE PROSPECTIVE USE OF THE ORBIT RADIATION OF A HIGH-ENERGY SYNCHROTRON I X-RAY PHYSICS IN THE 0.1 TO 20A REGION, by L. G. Parratt. Technical rept. no. 12 on Contract AF 18(600)300. 1 May 58, 14p. 3 refs. AFOSR TN-58-473; AD-158 284.
Order from LC mi$2.40, ph$3.30 PB 135 404

Stanford U., Calif.
WIDE ANGLE PAIR PRODUCTION AND QUANTUM ELECTRODYNAMICS AT SMALL DISTANCES, by D. J. Bjorken, S. D. Drell, and S. C. Frautschi. Technical rept. no. 34 on Contracts AF 49(638)388 and AF 18(600)545. June 58, 34p. 14 refs. AFOSR TN-58-597; AD-162 121.
Order from LC mi$3.00, ph$6.30 PB 136 158

Thermodynamics

Aeronautical Icing Research Labs., Smith, Hinchman and Grylls, Inc., Ypsilaanti, Mich.
AN INVESTIGATION OF THE HEAT-TRANSFER CHARACTERISTICS OF SPHERES IN FORCED CONVECTION, by A. E. Amerman. Rept. on Contract AF 33(600)8114. Dec 53, 19p. WADC Technical rept. 53-117, Suppl. 1; AD-28 401.
Order from LC mi$2.40, ph$3.30 PB 137 761

An investigation was conducted by the Aeronautical Icing Research Laboratories, of Smith, Hinchman & Grylls, Inc., at the 5-foot wind tunnel at Wright-Patterson Air Force Base to determine the heat-transfer characteristics of spheres of different diameters subjected to forced convective flow. The spheres were steam-heated and utilized a heat-meter plug to obtain local values of the unit thermal convective conductances, from which the average heat-transfer characteristics were determined. From these data, equations relating the average Nusselt number and the total Reynolds number were determined and published in WADC TR 53-117, dated April 1953, entitled "An Investigation of the Heat-Transfer Characteristics of Spheres in Forced Convection." From these same data, equations relating the local Nusselt numbers and local Reynolds numbers were desired and are presented in this supplement.

Heat Transfer Lab., U. of Minnesota, Minneapolis.
CALCULATION OF CONVECTION HEAT TRANSFER TO NON-ISOTHERMAL SURFACES EXPOSED TO A FLUID STREAM WITH WEDGE TYPE SURFACE PRESSURE GRADIENT, by J. P. Hartnett, E. R. G. Eckert and Roland Birkebak. Rept. on Contract AF 33(616)3038. July 58, 42p. 19 refs. WADC Technical rept. 57-753; AD-142 236.
Order from OTS $1.25 PB 151 622

A single design procedure is developed for the calculation of the local and total heat transfer rates from non-isothermal surfaces with prescribed wall temperature distributions. The method is initially developed for laminar wedge-type flows and for turbulent flow with zero pressure gradient. An extension of the method to cover heat transfer from non-isothermal surfaces with arbitrary pressure gradient is proposed. A solution for the inverse problem of calculating the wall temperature distribution along surfaces with a prescribed heat flow distribution is also presented for laminar wedge-type flows and for turbulent flow with zero gradient. Examples are presented to illustrate the proposed methods.

Heat Transfer Lab., Mass. Inst. of Tech., Cambridge.
DYNAMIC RESPONSE OF HEAT EXCHANGERS HAVING INTERNAL HEAT SOURCES, by Vedat S. Arpaci and John A. Clark. Rept. on Contract AF 33(616)3157. Dec 57, 41p. 20 refs. WADC Technical rept. 57-483; AD-155 807.
Order from OTS $1.25 PB 151 621

This paper considers the dynamic response of the temperature of the heat transfer surface and the fluid-surface temperature difference in a heat exchanger having internal heat sources experiencing a sudden change in the rate of heat generation. The results are obtained by a direct mathematical attack on the governing differential equations. These are presented such that the surface temperature may be computed as a function of space and time using three mathematical functions obtained by IBM machine reduction. The theory is compared with experimental measurements and favorable agreement is obtained. Heat exchangers to which the solutions apply include the heterogeneous nuclear reactor.

Princeton U., N. J.
A STUDY OF THE KINETICS OF THE HYDROGEN-OXYGEN REACTION IN A NEW FLOW REACTOR, by Rudolph J. Swigart. Technical rept. on Contract AF 18(600)1527. 15 Aug 58, 88p. 21 refs. Aeronautical Engineering Lab. rept. no. 432; [AFOSR] TN-58-823; AD-202 907.
Order from LC mi$4.80, ph$13.80 PB 138 168

A study of the kinetics of the hydrogen-oxygen reaction in the presence of large concentrations of nitrogen was made in a new type flow reactor under conditions which yielded data applicable to combustion processes in a rocket motor or ramjet combustor. The investigation

was carried out over a temperature range from 900 to 1000°K. Initial hydrogen molar concentrations varied from 0.00826 to 0.0166 and initial oxygen molar concentrations varied from 0.0075 to 0.1975.

Wave Propagation

Air Force Cambridge Research Center, Bedford, Mass.
RELATIVE EFFICIENCY OF PRESENT VHF IONOSPHERIC "BURSTS" AND "CONTINUOUS SCATTER" LONG-DISTANCE COMMUNICATION TECHNIQUES, by T. F. Rogers. June 58, 30p. 27 refs. AFCRC-TR-58-156; AD-152 435.
Order from LC mi$2.70, ph$4.80 PB 139 283

The transmission efficiencies of the "burst" and "continuous" vhf long-distance communication techniques are compared. For the same effective radiated power, an estimate is made of the teletype capacity which is available for 99 percent of a year's hours at an average character error rate of 1:1000. On the basis of published performance data it is concluded that, at the present time, the "continuous" technique yields a higher reliability-capacity product in the lower vhf region.

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
PHENOMENOLOGICAL VECTOR MODEL OF MICROWAVE REFLECTION FROM THE OCEAN, by C. I. Beard, I. Katz, and L. M. Spetner. Rept. on Contract NOrd-7386. July 55, 28p. 14 refs. CM-846.
Order from LC mi$2.70, ph$4.80 PB 137 127

A model of one-way transmission of microwave electromagnetic signals over the ocean surface is developed from experiment. The received signal is described as a vector sum of a constant direct signal; a coherent reflected signal, whose amplitude and phase are fixed by geometry and sea state; and a fluctuating reflected component of random amplitude and phase. By interpreting experimental data in the light of this phenomenological model it has been possible to relate, quantitatively, the coherent and incoherent reflected signal and total signal to geometry and sea state. The results give support to the theoretical expression previously derived by others relating the coherent reflected signal to "apparent ocean roughness." In addition, the general shape of the curve relating the incoherent scattering to "apparent ocean roughness" has been established and its asymptotic value found.

Columbia U. School of Engineering, New York.
CORRELATION FUNCTION AND POWER SPECTRA OF SCATTER PROPAGATION LINKS FOR ARBITRARY INPUTS, by Dimitri S. Bugnolo. Technical rept. T-1/C on Contract AF 49(638)350. 2 June 58, 15p. 9 refs. CU-1-58-AF1350-EE: AFOSR TN-58-463; AD-158 270.
Order from LC mi$2.40, ph$3.30 PB 136 271

The correlation function and corresponding power spectrum of an electromagnetic wave scattered by the atmosphere is related to the power spectrum of the source by a generalization of the notions of time variable linear networks. It will be shown that the power spectrum of the received signal can be regarded as the output of a system characterized by a tensor of the fourth rank.

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
AN OUTLINE OF THE MAGNETO-IONIC THEORY, PART I, by Henry G. Booker. Technical rept. no. 1 on Studies on Propagation in the Ionosphere, Contract W36-039-sc-44518. Mar 50. 113p. ATI-81 602.
Order from LC mi$6.00, ph$18.30 PB 139 291

The following is part I of an outline of the magneto-ionic theory of radio wave-propagation in the ionosphere. In addition to standard material appropriate for use when the direction of phase-propagation is vertical, some original material is included dealing with the way in which polarization ellipses are tilted out of the planes of constant phase (see Section 11, and the last part of Section 7). The concept of field-impedance is applied to the magneto-ionic theory in Section 12, and is used in Section 13 in connection with a discussion of energy-flow in magneto-ionic wave-components.

General Electric Research Lab., Schenectady, N. Y.
SHORT-TIME STATISTICS OF TROPOSPHERIC RADIO WAVE PROPAGATION, by R. G. Finney. Scientific rept. no. 1 on Contract AF 19(604)1723. June 58, 47p. 13 refs. AFCRC TN-58-185; AD-152 434.
Order from LC mi$3.30, ph$7.80 PB 136 053

This report describes the results of an experimental investigation of the short-time statistics which characterize beyond-the-horizon radio wave propagation. Specifically, the probability distribution and the period of stationarity of the received signal are treated. The data were analyzed by means of statistical techniques, including an F test and a goodness-of-fit test. Experimental and analytical procedures are described in detail, as are the results obtained. A tabulation of the basic data and a complete sample calculation are also included.

Institute of Mathematical Sciences, New York U., N. Y.
SURFACE WAVES ON A RIGHT ANGLED WEDGE, by Samuel N. Karp and Frank Karal. Rept. on Contract AF 19(604)1717. Aug 58, 33p. 17 refs. Research rept. no. EM-116; AFCRC TN-58-368; AD-160 813.
Order from LC mi$3.00, ph$6.30 PB 137 484

The fields produced by a line source located at the vertex of a right angled wedge, both of whose faces can sustain surface waves, were investigated. The mathematical formulation of the problem involves the use of an impedance boundary condition. The impedance represents the effect of a corrugation of the

surface, for example. It turns out that the radiated field is an elementary function of the observation angle. The surface wave amplitude tends to simple limiting values as its phase velocity tends to the velocity of propagation in free space, and also as the phase velocity is decreased without limit. The results are compared with similar results valid for a line source on an infinite plane. The method employed can be applied to treat wedges of more general angles.

Ionosphere Research Lab., Pennsylvania State U., University Park.
MEASUREMENTS OF THE VERTICAL INCIDENCE IONOSPHERIC ABSORPTION AT 75 KC/s, by G. A. Etzweiler and E. R. Schmerling. Scientific rept. no. 109 on Ionospheric Research, Contract AF 19(604)1304. 15 Aug 58, 128p. 8 refs. AFCRC TN-58-490.
Order from LC mi$6.30, ph$19.80 PB 135 942

The results of measurements of the absorption of radio waves at vertical incidence at a frequency of 75 kc/s are presented. The measuring techniques and equipments are described. The data are presented as diurnal plots of absorption for the period 1 Oct 55-25 Apr 57 and as monthly means for the interval Oct 55-Apr 57.

Maryland U., College Park.
FORMATION OF DISCONTINUITIES IN NON-LINEAR ELECTRODYNAMICS, by Morton Lutzky. Master's thesis. Rept. on Contract AF 49(638)24. 1958, 34p. 7 refs. Physics Dept. Technical rept. no. 111; AFOSR TN-58-633; AD-162 163.
Order from LC mi$3.00, ph$6.30 PB 136 400

It is shown that discontinuities can develop in the propagation of initially smooth waves governed by a classical non-linear theory of electrodynamics. The type of theory considered includes as a special case that of Heisenberg and Euler, up to second order in the invariants of the field; this theory describes the modifications that must be made in the Maxwell equations to include the classical limit of the non-linear vacuum effects of quantum electrodynamics.

Smyth Research Associates, San Diego, Calif.
LAREDO PROPAGATION FIELD TESTS, by J. L. Heritage, S. Weisbrod and others. Final engineering rept. Phase II on Contract AF 30(602)1624. July 58, 63p. 1 ref. SRA-60; RADC-TR-58-110; AD-148 859.
Order from LC mi$3.90, ph$10.80 PB 136 559

The program of experimental observations, calls for an extensive survey of tropospheric and ionospheric signals received from the Laredo transmitter. The point of view adopted is concentration on varying the important geometrical factors of the propagation path over the widest possible range.

Stanford Electronics Labs., Stanford U., Calif.
METEOR SCATTER, by Von R. Eshleman. Scientific rept. no. 4 on Contract AF 19(604)2193. Aug 58, 48p. 60 refs. AFCRC TN-58-370; AD-160 819.
Order from LC mi$3.30, ph$7.80 PB 136 878

This report is divided into three main parts. First is presented a review, extension, and discussion of the mechanism of radio scattering from meteor ionization trails under all combinations of low and high electron line density, long and short radio wavelength, and back and forward scattering. The second part consists of a review and discussion of the number distributions of echo amplitudes and durations, and a discussion of the diurnal and seasonal variations in the number and directions of arrival of meteor particles. In the final part the information on echo characteristics and meteor rate and radiant variations is used to obtain a description of the total fluctuating signal propagated over various paths by means of scattering from numerous meteor ionization trails.

Syracuse U. Research Inst., N. Y.
THE LEXINGTON-SYRACUSE TROPOSPHERIC SCATTER PROPAGATION LINK, by Joseph Dienst, LeRoy A. Mullin and others. Interim technical rept. no. 2, June 56-Oct 57, Contract AF 19(604)1179. Nov 57, 89p. 8 refs. SURI rept. no. EE312-5711 T4; AFCRC-TR-58-164; AD-152 401.
Order from LC mi$4.80, ph$13.80 PB 136 470

A primary task of the project has been the recording of the signal strengths received at Syracuse, N. Y. from a transmitter at Lexington, Mass., 248.9 miles away. The transmitter operated at a carrier frequency of 915 mc. A study was made of the correlation between propagation data and meteorological conditions in the transmission path. The relative behavior of certain antennas for scattered signals and line-of-sight signals was compared.

Tennessee University. Engineering Experiment Station, Knoxville, Tenn.
RESEARCH IN METEOR-SCATTERING COMMUNICATION, by W. E. Deeds. Technical rept. 1 on Contract Nonr-811(05). 1 Sep 57, 16p.
Order from LC mi$2.40, ph$3.30 PB 135 889

This report is divided into two sections. The first section describes a type of antenna mount which ensures that both the transmitting and the receiving antennas have the optimum polarization for radio transmission via radio waves scattered from a small region of ionization, such as a meteor trail. The mount is an equatorial form with the polar axis along the line joining the two stations, and the antenna should be polarized parallel to the declination axis. The second section of the report describes a mechanical analog for predicting the optimum directions for pointing the antennas used in meteor scatter communication, subject to the assumption that there is some ecliptic concentration of meteor radiants.

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Electronics Research Labs., Columbia U., New York.
ON A PROPERTY OF WIENER FILTERS, by Moshe

Zakai. Technical rept. T-8/133 on Contract AF 19(604)1572. 15 July 58, 23p. 7 refs. CU-14-58-AF-1572-EE; AFCRC TN-58-354; AD-160 794.
Order from LC mi$2.70, ph$4.80 PB 136 578

Let $Y(\omega, \alpha)$ be the Wiener filter designed to yield an output which is the least square approximation to $s(t+\alpha)$ where $s(t)$ is the desired signal input. Let $Y_L(\omega)$ be the Wiener filter designed to yield an output which is the least square approximation to some linear operation L on the desired signal input. The following simple relationship has been shown to hold between $Y(\omega, \alpha)$ and $Y_L(\omega)$. If $s(t)$ is the desired signal input and $L_\alpha[s(t+\alpha)]$ is the desired output, where L_α is some linear operation with respect to α, than $Y_L^\alpha(\omega) = L_\alpha[Y(\omega, \alpha)]$.

Willow Run Labs., U. of Michigan, Ypsilanti.
FREQUENCY OF OCCURENCE OF WORDS: A STUDY OF ZIPF'S LAW, WITH APPLICATION TO MECHANICAL TRANSLATION, by Andreas M. Koutsoudas and Robert E. Machol. Rept. on Project Michigan, Contract DA 36-039-sc-52654. June 57, 18p. 7 refs. 2144-147-T.
Order from LC mi$2.40, ph$3.30 PB 135 856

Existing laws concerning the frequencies of words in language--specifically Zipf's and Joos' laws--are examined by means of new formulas which permit comparison of these laws with easily obtainable data. The laws are shown to be inaccurate and inadequate for predicting the size of dictionary necessary for mechanical translation, or the frequency with which words not in a dictionary of given size will be found. It is concluded that an empirical approach to this problem is most promising.

Photographic Equipment

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
ELECTRONIC CONTRAST SELECTOR AND GRAIN SPACING TO LIGHT INTENSITY TRANSLATOR FOR PHOTOGRAPHIC ENLARGEMENTS, by Radames K. H Gebel. Apr 58, 11p. WADC Technical Note 58-110; AD-151 178.
Order from OTS $0.50 PB 151 585

An electronic method is described which can readily extract information from a very low contrast photograph, which is almost impossible to detect with the human eye. The electronic equipment, which can be called a computer, counts developed grains in the photograph and presents a revised photograph on a cathode ray tube in which concentrations of grains that are in excess of the background over an area large enough to be significant are printed in gray scale values. The cathode ray tube picture is photographed for record. This device can be used for obtaining information from photographs of the earth taken from a space vehicle or from the moon, or for obtaining photographic records of celestial bodies that are normally lost in the background of the universe.

Naval Photographic Interpretation Center, Washington, D. C.
EVALUATION OF PHOTOGRAPHIC INTERPRETATION SCALES. May 57, 19p. Final rept. on Proj. TED-PIC-PH-4737. PIC rept. 208/57-U.
Order from LC mi$2.40, ph$3.30 PB 137 725

At present, there are two basic methods of making linear measurements on photographs. For distances of less than 0.06 ft., the tube magnifier may be used. For distances of more than 0.06 ft., a scale, usually divided into thousandths of a foot, is used either by laying it directly onto the photo or by measuring the distance with dividers and checking against a scale. In an attempt to improve the measuring capability of the photo interpreter, a series of transparent scales have been designed under this project.

Navy Electronics Lab., San Diego, Calif.
THE NEL TYPE III DEEP-SEA CAMERA, by C. J. Shipek. 13 Mar 57, 16p. 11 refs. NEL/Rept. 768.
Order from LC mi$2.40, ph$3.30 PB 136 888

This report discusses the development, design and use of the NEL Type III Deep-Sea Camera to study microrelief features of bottom sediments.

Rome Air Development Center, Griffis AFB, N. Y.
RECTIFICATION OF PANORAMIC PHOTOGRAPHS, by Leroy E. Ross, Jr. July 58, 48p. 6 refs. RADC TN-58-187; AD 148 808.
Order from LC mi$3.30, ph$7.80 PB 137 348

Panoramic photography is becoming increasingly important in the field of aerial photography. Because of increased efficiency of aircraft warning facilities and accuracy of antiaircraft missiles, however, it has become necessary to take oblique photographs from higher altitudes and greater distances. A more efficient method of obtaining oblique photography is by use of panoramic cameras. Panoramic photography has peculiar geometric qualities which require unique rectification. Three methods of rectification to effectively utilize this photography are discussed: (1) a pancratic lens coupled to a slit scanning device; (2) a mechanical rectifier, using moving film and paper; and (3) a mathematical solution. In view of the limitations of the various rectifiers, it is felt that the pancratic lens - slit scan system would be the most practical for field use and that it could replace the current trimetrogon method of charting

SOCIAL SCIENCES

Stanford U., Calif.
FORECASTING IN ITS RELATION TO GOVERNMENT POLICY-MAKING, by H. Theil. Technical rept. no. 47 on Contract N6onr-251(33). 14 Oct 57, 33p. 6 refs.
Order from LC mi$3.00, ph$6.30 PB 137 720

Documentation

Armed Services Technical Information Agency, Arlington, Va.
ASTIA SUBJECT HEADINGS. 4th ed. Jan 59, 761p.
Order from OTS $8.00 PB 151 568

This edition supersedes previously dated editions and supplements. Although some subject headings have been modified and some deleted, the principles of direct and specific headings are still followed. Each heading represents one or more reports actually in the collection of the Armed Services Technical Information Agency or available to it; therefore, the scope of the list is only as diverse as the collection itself.

Documentation, Inc., Washington, D. C.
AN EVALUATION OF USE STUDIES OF SCIENTIFIC INFORMATION, by Mortimer Taube. Rept. on Contract AF 49(638)91. Dec 58, 24p. 15 refs. AFOSR TN-58-1050; AD-206 987.
Order from LC mi$2.70, ph$4.80 PB 138 260

This paper attempts an evaluation of the total existing literature of use studies. It accepts the conclusions drawn by other surveys of use studies which appeared before the International Conference on Scientific Information in November, 1958, and brings these conclusions up to date by abstracting and evaluating the studies prepared for the Conference. An attempt is made to analyze the reasons for the generally accepted failure of use studies by establishing a distinction between consumer services and professional services. It is concluded that the organization and dissemination of scientific information is a professional activity, the value of which cannot be measured by consumer responses, and that such responses cannot supply directions for the design of more effective scientific information and reference systems.

MISCELLANEOUS

Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS. May 59.
Order from OTS $1.25, $10.00/year PB 151 338

Contents:
Articles:
The 100-inch airborne radiometer, by C. F. Bieber and H. L. Clark
Effects of trade wind meteorology on radar coverage, by W. S. Ament, C. G. Purves, and D. L. Randall
Particle drifts in plasmas, by A. H. Aitken
Scientific Program:
Astronomy and Astrophysics: Utilization of meteorological data from Transonde Flight 202
Chemistry: Distillates of coal tar creosote improve resistance of wood to marine borer attack
Mechanics: Effect of dynamic preloads on the mechanical properties of steel. Braking system designed for 3-watt synchronous clock motor employed in studies of yield delay time. Prediction of the mean square response of a linear elastic structure. Static firing tests of solid-propellant rocket motors in "coffin" assemblies. Relative thermoelectric power of hydrogenated palladium as a function of absolute temperatures (10^{o}K to 110^{o}K). New ignition system simplifies NRL valveless pulsejet operation and eliminates fire hazard
Metallurgy and Ceramics: Improved magnetically operated valve for high-vacuum analysis systems. Notch toughness of high strength structural steels as a function of heat treatment. Radiation damage of metals. Cathodic protection, hydrogen embrittlement, and stress-corrosion cracking
Nuclear and Atomic Physics: Study of photoprotons from light elements by a counter method. Time-dependent formulation of damping theory applicable to various line-broadening problems in high-temperature physics. Few-group, multiregion, one-dimensional reactor code for NRL's electronic digital computer (NAREC)
Radio: Conical monopole antenna. Characteristics of radio waves in nonmagnetic conductive media. Wide-range multiple-pulse amplifier. High-current grid-controlled electron multiplier tube. Great-circle calculations by digital computer. Effects of nuclear irradiation upon the microwave properties of certain ferrites
Solid-State Physics: High loss ferromagnetic materials in waveguide dummy loads and attenuators. Energy level position of Ag centers in the sulfides

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General

Civilian application releases through 1958. Sandia Corp. Albuquerque, N. Mex. Jan 1959. Contract AT-(29-1)-789. 57p. Order from OTS. $1.50. SCR-62

Biology and Medicine

Biochemical mechanism of nitrate reduction in bacteria. Final report for period July 1, 1951-June 30, 1958. Agricultural Experiment Station. Stillwater, Okla. 1958. Contract AT(11-1)-71. Project no. 4 30p. Order from LC. Mi $2.70, ph $4.80. AECU-3841

The development of chelating agents for enhancing the urinary excretion of strontium. Period covered: Dec. 1, 1957 to Sept. 1, 1958, by Harry Kroll. Montefiore Hospital. New York, N. Y. Sep 1958 Contract AT(30-1)-2094. 28p. Order from LC. Mi $2 70, ph $4.80. AECU-3842

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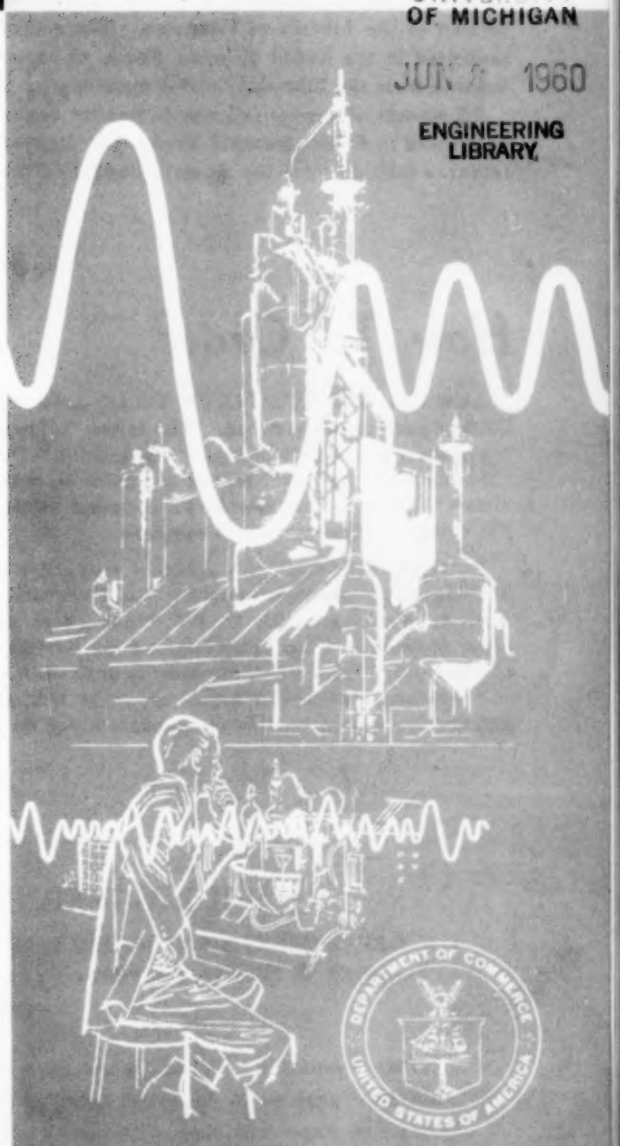

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		AERE C/R 2456
		AERE C/R 2566
		AERE C/R 2612
	319	AERE EL/M 70
	356	AERE M/R 2554
	358	AERE C/R 1575(1-6) Sup-2
	359	AERE I/R 2630
		AERE R/R 2602
	361	AERE E/M 63
		AERE E/R 2625
	363	AERE T/R 1888
	367	AERE CE/R 2496
Atomics International, Canoga Park, Calif.	475	151 609
Audiology Lab., Northwestern U., Evanston, Ill.	86	134 365
Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.	37	135 182
	293	137 105
	401	137 047
	403	135 507
Aviation Psychology Lab., Ohio State U. Research Foundation, Columbus This name has been changed to Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus		
Avion Div., American Car and Foundry Co., Paramus, N. J.	26	134 278
Babcock and Wilcox Co., Alliance, Ohio	168	135 674
	218	135 869
Babcock and Wilcox Co., Alliance, Ohio (con.)	469	131 992
Ballistic Research Labs., Aberdeen Proving Ground, Md.	19	134 282
	24	134 283
	31	134 284
	32	134 281
	41	134 285
	175	151 117
	223	135 513
	242	135 346
		135 347
	304	137 554
	310	136 759
	319	138 129
	327	137 307
	328	137 305
		137 306
		137 308
		137 814
	339	137 128
	341	139 036
	346	136 423
	347	135 337
	369	136 990
		151 147
	439	139 623
	440	136 424
	459	136 571
Battelle Memorial Inst., Columbus, Ohio	8	135 276
	19	133 883
	28	135 665
	52	135 279
	101	151 278
	148	136 681
		136 682
	156	135 672
		135 681
	165	131 999
	167	151 314
	210	151 459
	218	135 905
	231	151 483
	240	136 234
	249	151 125
	252	NACA TN-4372
	304	136 173
	319	136 293
		136 294
	320	138 553
	331	136 136
	332	136 408
	335	137 197
	345	151 596
	340	135 334
	356	135 724
		151 562
	427	136 462
	448	131 074
	468	138 570
	471	151 624
	482	136 193

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Bausch and Lomb Optical Co., Rochester, N. Y.	308	138 555
Baylor U. Waco, Tex.	201	151 485
Beach Erosion Board, Corps of Engineers, Washington, D. C.	11	133 287
Beech Aircraft Corp., Wichita, Kansas.	210	151 479
Bell Aircraft Corp., Buffalo, N. Y.	311	137 013
	446	136 418
	464	135 748
Bell Telephone Labs., Inc., Murray Hill, N. J.	343	136 253
	320	136 722
Bjorksten Research Labs., Inc., Madison, Wis.	331	138 029
	454	137 078
Boeing Airplane Co., Seattle, Washington	160	134 996
	215	151 328
	311	151 116
Bogue Electric Mfg., Co., Paterson, N. J.	148	135 288
Bolt, Beranek, and Newman, Cambridge, Mass.	257	151 501
	424	151 652
Bond Rubber Corp., Derby, Conn.	46	135 181
Boston Coll., Chestnut Hill, Mass.	427	135 214
British Columbia U. (Canada)	342	136 258
		136 259
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Brooke Army Medical Center, Fort Sam Houston, Tex.	131	135 059
	200	135 954
	403	137 853
Brown U., Providence, R. I.	242	136 079
	352	137 125
	365	135 506
	460	151 591
Brown U. Div. of Applied Mathematics, Providence, R. I.	32	133 227
	38	135 138
	347	137 022
	350	138 633
	465	139 287
Brown U. Div. of Engineering, Providence, R. I.	99	133 338
Brown U., Div. of Engineering, Providence, R. I. (con.)	172	135 727
Bulova Research and Development Labs., Inc., Woodside, N. Y.	334	136 004
Bureau of Aeronautics, Dept. of the Navy, Washington, D. C.	157	131 265 (rev.)
	227	135 607
	419	139 608
Bureau of Mines, Pittsburgh, Pa.	8	134 308
Bureau of Ordnance, Dept of the Navy, Washington, D. C.	223	135 079
Bureau of Ships, Washington, D. C.	154	151 351
	320	137 646
Bureau of Yards and Docks, Washington, D. C.	424	139 126
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Burroughs Corp., Paoli, Pa.	176	135 734
California Agricultural Experiment Station, Davis, Calif.	25	135 353
	151	131 953
California Inst. of Tech., Pasadena.	36	134 722
	196	136 135
	248	135 750
	251	135 429
	351	135 868
		136 124
		136 440
		139 030
	357	135 428
	367	136 224
		136 439
California U., Berkeley.	26	135 350
	84	135 535
	159	135 591
	215	129 341
	237	136 281
	304	136 161
	342	136 395
	367	136 257
	403	138 000
	457	135 976
		136 436
		136 437
		136 438
	469	139 622
California U., Los Angeles	6	135 131
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Carnegie Inst., of Tech., Pittsburgh, Pa.	47	133 232
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	163	131 943
	252	NACA 1331
	342	136 272
	427	135 257
	457	135 364
		135 991
Carnegie Inst. of Tech. Graduate School of Industrial Administration, Pittsburgh, Pa.	448	125 032
Carter Observatory (New Zealand)	392	138 689
Case Inst. of Tech., Cleveland, Ohio.	49	134 969
	101	135 418
	250	135 324
	427	138 966
	461	NACA TM-1439
	463	NACA TM-1437
Cauchotex Industries, Inc., San Juan, P. R.	445	137 428
Cedars of Lebanon Hospital, Los Angeles, Calif.	87	134 369
Center for Documentation and Communication Research, Western Reserve U., Cleveland, Ohio	264	136 235
Cessna Aircraft Co., Wichita, Kans.	347	137 924
		137 925
Chase Brass and Copper Co., Inc. Waterbury, Conn.	471	151 623
Chatham Electronics Div., Gera Corp., Livingston, N. J.	218	136 040
	320	138 087
Chemical Corps Medical Labs., Army Chemical Center, Md. This name has been changed to Army Chemical Warfare Labs., Army Chemical Center, Md.		
Chesapeake Bay Inst., Johns Hopkins U., Annapolis, Md.	209	136 110
Chesapeake Bay Inst., Johns Hopkins U., Annapolis, Md. (con.)	417	136 122
Chicago U., Ill.	30	151 242
	97	134 433
	97	151 255
	99	151 319
	148	151 416
	237	135 982
	296	137 204
		138 118
	308	136 211
	405	136 855
	410	139 286
Chrysler Corp. Missile Operations, Detroit, Mich.	150	134 318
City Coll. of the City of New York	9	133 328
Cleveland Pneumatic Tool Co., Ohio	312	136 468
Clevite Corp., Cleveland, Ohio	223	136 090
Cloud Physics Lab., U. of Chicago, Ill.	308	136 246
	414	136 030
Coating and Chemical Lab., Aberdeen Proving Ground, Md.	42	131 738
	202	135 341
	235	151 032
		151 033
	301	135 342
	409	136 242
	423	137 563
	446	135 572
	454	136 731
		138 426
Colorado A. and M. Coll. Fort Collins. This name has been changed to Colorado State U., Fort Collins		
Colorado State U. (formerly Colorado A. and M. Coll.) Fort Collins	260	136 220
	391	139 550
	478	136 205
Columbia U., New York.	19	133 341
	30	132 979
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	42	134 534
	49	134 965
	53	133 355
	159	135 579
	204	136 843
	402	151 632
	413	137 060

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Columbia U. School of Engineering, New York	320	136 870
	344	136 262
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Communication and Navigation Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio	91	135 403
Connecticut Coll., New London	293	138 492
	399	138 221
Connecticut U., Storrs.	195	135 888
	293	135 890
	399	135 891
Conrac, Inc., Glendora, Calif.	214	151 288
Container Labs., Inc., Washington, D. C.	445	136 137
Continental Oil Co., Ponca City, Okla.	29	151 265
Control Specialists, Inc., Inglewood, Calif.	193	151 465
Control Systems Lab., U. of Illinois, Urbana	11	133 813
	89	133 827
Convair, Fort Worth, Tex.	168	136 815
		136 816
	169	136 817
		136 818
	257	151 501
	262	136 150
	359	139 021
	360	139 022
	474	151 358
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	475	139 348
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	482	139 023
Cook Electric Co., Skokie, Ill.	459	136 209
Cook Research Labs., Chicago, Illinois	206	135 885
	312	137 386
Cooperative Research Foundation, San Francisco, Calif.	138	134 398
Cornell Aeronautical Labs., Inc., Buffalo, N. Y.	9	134 420
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Cornell Aeronautical Lab., Inc., Buffalo, N. Y. (con.)		151 445
		151 456
		151 457
	242	151 488
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		151 561
	336	137 396
	347	138 852
	353	139 049
	419	139 292
	427	139 629
Cornell U., Ithaca, N. Y.	30	134 309
		134 310
		134 414
		134 863
	45	133 326
	159	134 413
	160	134 928
	237	135 981
		135 989
	262	151 040
	410	139 199
	457	135 988
		136 420
	484	135 404
Cornell U. Medical Coll., New York	132	135 396
Cornell U. School of Electrical Engineering, Ithaca, N. Y.	51	133 594
	485	139 291
Crane Co., Chicago, Ill.	471	131 617
Crucible Steel Co. of America, Pittsburgh, Pa.	229	151 415
	353	151 558
Cruft Lab., Harvard U., Cambridge, Mass.	175	135 503
	320	136 042
Cryogenic Engineering Lab., Mass. Inst. of Tech., Cambridge.	411	139 363
Cryogenic Lab., Ohio State U. Research Foundation, Columbus.	368	137 302
Curtiss-Wright Corp., Caldwell, N. J.	39	151 243
Dalmo Victor Co., Belmont, Calif.	320	151 549
Dalmo Victor Co., San Carlos, Calif.	218	136 208
David Taylor Model Basin, Washington, D. C.	21	131 785
	36	133 815
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David Taylor Model Basin, Washington, D. C. (con.)	248	136 472
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	446	137 526
	460	135 328
	465	137 181
		137 182
		137 515
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Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio	164	131 940
		151 061
	354	121 634S
		151 062
	448	151 063
	471	139 551
Defense Research Lab., U. of Texas, Austin	263	135 332
De Havilland Aircraft of Canada, Ltd.	141	135 588
Department of Commerce, Washington, D. C.	477	137 581
		137 582
Detroit Arsenal, Center Line, Mich.	159	135 333
	252	136 206
	333	137 527
	334	136 429
	341	137 532
Deutscher Wetterdienst, Aachen (West Germany)	139	133 809
Deutscher Wetterdienst, Frankfort (West Germany)	10	133 808
Diamond Ordnance Fuze Labs., Washington, D. C.	9	135 145
	19	133 817
	20	131 787
	20	134 634
	52	134 424
	104	135 144
	163	131 938
	170	133 816
	219	136 026
		136 027
		136 028
	265	151 118
	428	137 087
		137 380
		137 389
	440	137 666
	479	137 402

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Dielectrics Lab., Johns Hopkins U., Baltimore, Md.	321	151 014
	428	136 196
Directorate of Flight and All-Weather Testing, Wright-Patterson AFB, Ohio	210	136 203
	242	137 157
	312	136 410
Documentation, Inc., Washington, D. C.	52	135 268
	106	134 759
	488	138 260
Douglas Aircraft Co., Inc., El Segundo, Calif.	257	151 477
	460	139 191
Dow Chemical Co., Madison, Ill.	334	151 536
Dow Chemical Co., Midland, Mich.	40	135 201
		135 202
		135 340
	355	136 675
Dugway Proving Ground, Utah	138	135 593
	209	136 104
Duke U., Durham, N. C.	299	136 127
DuMont, Allen B., Labs., Inc., Clifton, N. J.	214	151 289
Dunlap and Associates, Inc., Stamford, Conn.	148	135 736
	290	137 463
	329	151 055
Eagle-Picher Research Labs., Joplin, Mo.	134	135 719
	219	135 904
Eastern Research Group., Brooklyn, N. Y.	212	134 545
Eaton Electronics Research Lab., McGill U. (Canada)	365	137 652
Eclipse Pioneer Div., Bendix Aviation Corp., Teterboro, N. J.	210	136 203
	333	137 718
Ecole Normale Superieure (France)	253	136 210
Edgerton, Germeshausen and Grier, Inc., Boston, Mass.	321	137 519
		138 672
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Educational Testing Service, Inc., Princeton, N. J.	5	134 458

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Educational Testing Service, Inc., Princeton, N. J. (con.)	6	134 432
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Electrical Engineering Research Lab., U. of Illinois, Urbana.	20	134 344
		134 665
	148	135 119
	365	137 995
Electrofilm Corp., North Hollywood, Calif.	327	135 495
Electronic Components Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio	342	139 034
Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.	20	134 583
	321	151 332
	363	135 338
Electronics Research Lab., U. of California, Berkeley.	20	134 484
		135 100
	148	135 099
	237	135 994
	322	136 273
	363	135 551
		151 551
Electronics Research Lab., Northeastern U., Boston, Mass.	257	135 963
Electronics Research Labs., Columbia U., New York	20	134 989
	321	136 575
	362	137 790
	363	137 248
	487	136 578
Emerson and Cuming, Inc., Canton, Mass.	95	131 835
Emerson Radio and Phonograph Corp., Jersey City, N. J.	219	151 545
Empire Devices, Inc., Bayside, N. Y.	322	136 232
Engineering Div., Air Material Command, Wright-Patterson AFB, Ohio	312	137 386
Engineering Research Inst., U. of Michigan, Ann Arbor This name has been changed to Michigan U. Research Inst., Ann Arbor		
Equipment Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio	328	138 853
Equipment Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio (con.)	422	151 520
	459	137 765
Erie Resistor Corp., Pa.	92	136 673
Esso Labs., Linden, N. J.	304	136 230
		139 027
European Office, Air Research and Development Command.	465	136 189
Explosives Research Group, U. of Utah, Salt Lake City.	328	135 718
F-R Machine Works, Inc. Woodside, N. Y.	148	135 120
Fairchild Engine Div., Deer Park, N. Y.	88	135 266
Fansteel Metallurgical Corp., North Chicago, Ill.	234	136 716
	235	136 714
		136 715
Farrand Optical Co., Inc., New York	240	136 693
Federal Telecommunication Labs., Nutley, N. J.	231	135 874
	322	136 473
Feltman Research and Engineering Labs. (formerly Samuel Feltman Ammunition Labs.), Picatinny Arsenal, Dover, N. J.	25	132 952
		134 406
	173	135 093
	224	136 833
	233	135 434
	235	135 515
	328	135 940
		138 130
	329	137 468
		137 577
	336	151 128
	340	151 151
	440	136 401
		137 578
		137 764
		138 407
		138 415
	441	135 566
		137 467
		138 414
		138 433
	446	137 398
	455	138 406
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Firth Sterling, Inc., Pittsburgh, Pa.	231	136 766

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Flight Control Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio	312	151 541
Florida State U., Tallahassee.	10	135 250
	259	131 949
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Florida U., Gainesville	135	134 987
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Florida U. Engineering and Industrial Experiment Station, Gainesville	322	137 098
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Floyd Newman Lab. of Nuclear Studies, Cornell U., Ithaca, N. Y.	253	137 054
Ford Motor Co., Dearborn, Mich.	334	138 158
	335	137 503
	352	137 502
Forest Products Lab., Madison, Wis.	95	135 746
	331	151 547
Frankford Arsenal, Philadelphia, Pa.	235	135 117
	364	136 105
Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.	47	151 262
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	251	135 083
	258	151 420
		151 468
	304	151 521
Freudenthal, Alfred M., New York	260	151 516
Gas Turbine Lab., Mass. Inst. of Tech. Cambridge	162	135 105
	348	139 028
Gates and Crellin Labs. of Chemistry, Calif. Inst. of Tech., Pasadena	304	136 020
General Electric Co., Hudson Falls, N. Y.	428	139 618
General Electric Co., Owensboro, Ky.	219	151 489
General Electric Co., Schenectady, N. Y.	212	151 519
General Electric Research Lab., Schenectady, N. Y.	9	135 190
	485	136 053
General Mills, Inc., Minneapolis, Minn.	215	135 385
	230	135 704
		135 705
	425	137 793
General Precision Lab., Inc., Pleasantville, N. Y.	214	151 288
General Research Co., Beverly Hills, Calif.	102	134 412
Geophysical Inst., U. of Alaska, College	263	136 215
George Washington U., Washington, D. C.	196	151 494
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Georgetown Coll. Observatory, Washington, D. C.	139	135 559
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Georgia Inst. of Tech., Atlanta	34	134 331 (TN 4330)
Georgia Inst. of Tech. Engineering Experiment Station, Atlanta	92	135 248
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Giannini Research Lab., Santa Ana, Calif.	26	134 980
Goodrich, B. F., Co., Akron, Ohio	210	136 203
Goodrich, B. F., Co., Brecksville, Ohio	254	136 237
Goodyear Aircraft Corp., Akron, Ohio	294	137 251
	313	139 035
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Gordon McKay Lab. of Applied Physics, Harvard U., Cambridge, Mass.	47	132 053
		132 055
	261	151 020
Gottingen U. (West Germany)	296	138 690
Grinnell Coll., Iowa.	136	135 745

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Grumman Aircraft Engineering Corp., Bethpage, N. Y.	351	151 475
Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.	32	135 142
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		136 200
		136 201
	313	136 198
		136 202
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Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.	89	135 209
	243	137 394
	420	136 043
Haloid Co., Rochester, N. Y.	335	137 197
Harris Research Labs., Washington, D. C.	453	136 730
Harshaw Chemical Co., Cleveland, Ohio.	49	151 276
Harvard Coll. Observatory, Cambridge, Mass.	83	135 249
Harvard Medical School, Cambridge, Mass.	402	136 021
Harvard U., Cambridge, Mass.	87	135 450
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	343	136 252
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Harvard U. Div. of Engineering and Applied Physics, Cambridge, Mass.	209	135 973
Heat Transfer Lab., Illinois Inst. of Tech., Chicago	13	130 398
		130 810
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Heat Transfer Lab., Mass. Inst. of Tech., Cambridge.	484	151 621
Heat Transfer Lab., U. Minnesota, Minneapolis	348	136 222
	484	151 622
Heintz Mfg., Co., Philadelphia, Pa.	163	135 708
Highway Research Board, National Research Council, Washington, D. C.	143	NRC-546
		NRC-550
Highway Research Board, National Research Council, Washington, D. C. (con.)	291	NRC-604
Hiller Helicopters, Palo Alto, Calif.	100	135 188
Hooker Electrochemical Co., Niagara Falls, N. Y.	29	135 194
Horizons, Inc., Cleveland, Ohio.	170	135 263
	220	151 484
	232	151 451
	250	135 694
Houghton Labs., Inc., Olean, N. Y.	220	135 740
	322	135 755
		135 756
	323	136 059
		139 052
Hughes Aircraft Co., Culver City, Calif.	21	132 193
	323	137 354
	436	136 032
Human Engineering Lab., Aberdeen Proving Ground, Md. This name has been changed to Army Ordnance Human Engineering Lab., Aberdeen Proving Ground, Md.		
Human Factors Research, Inc., Los Angeles, Calif.	193	136 041
	291	138 967
Human Resources Research Office, George Washington U., Washington, D. C.	4	135 106
	84	135 143
	395	136 218
Hydrodynamics Lab., Calif. Inst. of Tech., Pasadena	37	134 422
	224	135 080
	466	136 231
		139 624
		139 628
Hydrodynamics Lab., Mass. Inst. of Tech., Cambridge.	248	136 290
Hydrogen Peroxide Labs., Mass. Inst. of Tech., Cambridge	301	135 443
Illinois Inst. of Tech., Chicago	262	151 517
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Illinois State Water Survey, Urbana.	140	134 393
Illinois U., Urbana	3	132 319
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	231	136 694
	330	137 374
	336	138 659
	365	136 388
	410	139 281
Illinois U. Coll. of Education, Urbana	294	136 228
Illinois U. Engineering Experiment Station, Urbana	305	135 621
	336	137 570
	337	137 280
		137 490
		137 571
		137 716
		138 464
	357	137 491
	368	136 415
	469	151 673
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Imperial Coll. of Science and Tech., London (Gt. Brit.)	305	136 263
Indiana U., Bloomington	296	135 453
Industrial Test Lab., Philadelphia Naval Shipyard, Pa.	39	131 794
	154	137 103
	453	137 544
	471	138 007
Inland Testing Labs., Chicago, Ill.	102	135 128
Inorganic Research Lab., Western Reserve U., Cleveland, Ohio	301	135 739
Institute for Advanced Study, Princeton, N. J.	159	135 154
	160	134 928
	237	135 960
Institute for Applied Experimental Psychology, Tufts U., Medford, Mass.	3	100 814rev.
	195	136 216
	296	136 774
	393	131 507S
Institute for Cooperative Research, Johns Hopkins U., Baltimore, Md.	50	132 650
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Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Pk	100	135 365

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Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Pk. (con.)		135 366
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	173	135 617
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	345	138 263
	349	136 256
	458	135 575
Institute for Research In Human Relations, Philadelphia, Pa.	129	135 387
Institute for System Research, U. of Chicago, Ill.	243	151 478
Institute for the Study of Rate Processes, U. of Utah, Salt Lake City.	28	134 968
	49	134 531
	155	135 431
	156	135 747
	337	136 153
Institute of Aerophysics, U. of Toronto (Canada)	162	134 415
Institute of Andean Biology, (Peru)	296	137 928
Institute of Applied Psychology, U. of Maryland, College Pk.	399	139 619
Institute of Aviation, U. of Illinois, Urbana.	420	131 660
Institute of Child Welfare, U. of Minnesota, Minneapolis	400	135 492
Institute of Engineering Research, U. of California., Berkeley.	33	151 228
	37	134 286
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		134 425
	244	151 414
		151 417
		151 449
	262	137 126
	351	136 121
	356	139 050
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Institute of Flight Structures, Columbia U., New York	345	137 714
Institute of Geophysics, U. of California., Los Angeles.	90	135 628
Institute of Mathematical Sciences, New York U., New York	104	135 505

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Institute of Mathematical Sciences, New York U., New York (con.)	175	135 400
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Institute of Optics, U. of Rochester, N. Y.	104	132 290
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	364	136 264
Institute of Personality Assessment and Research, U. of California, Berkeley	292	137 117
Institute of Polymer Research, Polytechnic Inst. of Brooklyn, N. Y.	157	135 454
	411	136 168
Institute of Rubber Research, U. of Akron, Ohio	96	131 795
Institute of Statistics, North Carolina U., Chapel Hill	97	135 374
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	265	136 070
	458	133 405
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Institute of Tech., U. of Minnesota, Minneapolis	135	136 776
Instituto Nazionale di Oticca (Italy)	402	136 000
Instrumentation Lab., Mass. Inst. of Tech., Cambridge	149	135 698
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International Latex Corp., Dover, Del.	341	139 045
International Research Associates, Inc., New York	4	134 459
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Ionosphere Research Lab., Pennsylvania State U., University Park.	175	135 497
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Iowa Engineering Experiment Station, Ames	205	135 522
Iowa State Coll., Ames.	294	136 123
Iowa State U., Iowa City.	5	134 464
Istituto Elettrotecnico Nazionale "Galileo Ferraris" (Italy)	305	135 367
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James Forrestal Research Center, Princeton, N. J.	152	135 480
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Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.	17	133 818
	18	134 407
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	157	135 689
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	339	137 700
Johann Wolfgang Goethe Universitat, Frankfort, (West Germany)	10	134 404
Johns Hopkins U., Baltimore, Md.	8	131 758
	37	134 960
	136	135 265
	294	139 046
	402	135 626
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Johns Hopkins U. School of Engineering, Baltimore, Md.	429	133 065-R
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Kidde, Walter, and Co., Inc., Belleville, N. J.	211	151 455
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Laboratorio di Meccanica Applicata del Politecnico di Torino (Italy)	461	136 183
Laboratory for Applied Biophysics, Mass. Inst. of Tech., Cambridge.	44	131 837
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Laboratory of Climatology, Drexel Inst. of Tech., Centerton, N. J.	138	135 693
Laboratory of Experimental Stress Analysis, Illinois Inst. of Tech., Chicago.	173	135 309
Laboratory of Social Relations, Harvard U., Cambridge, Mass.	195	136 023
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Laboratory of Statistical Research, U. of Washington, Seattle	160	134 996
Laboratory of Vitamin Tech., Inc., Chicago, Ill.	331	131 954
Land Locomotion Research Lab., Ordnance Tank-Automotive Command, Center Line, Mich.	10	134 385
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	238	130 883
	240	130 877
		130 881
	258	130 888
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Lovell Chemical Co., Watertown, Mass.	132	136 545
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Mapping and Charting Research Lab., Ohio State U. Research Foundation, Columbus	89	135 490
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	238	136 034
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	308	136 015
	317	139 048
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Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio	8	135 198
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Melpar, Inc., Falls Church, Va.	257	135 963
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Metal Hydrides, Inc., Beverly, Mass.	87	131 875
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	265	135 439
	306	138 982
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		136 292
	339	135 913
	357	151 537
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		139 620
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Microwave Development Labs., Inc., Wellesley, Mass.	221	136 111
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Microwave Lab., Stanford U., Calif.	21	132 205
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Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.	22	132 951
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Millipore Filter Corp., Watertown, Mass.	401	138 887
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Minerals Research Lab., U. of California, Berkeley.	28	131 789
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	228	151 505
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	333	137 258
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Naval Air Development Center, Johnsville, Pa.	348	136 394
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Naval Civil Engineering Lab., (formerly Naval Civil Engineering Research and Evaluation Lab.) Port Hueneme, Calif.	18	134 997
		135 133
	26	134 357
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Naval Ordnance Lab., White Oak, Md.	45	151 282
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	162	135 565
	169	135 437
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Naval Supply Research and Development Facility, Bayonne, N. J. (formerly Navy Clothing and Textile Office, Brooklyn, N. Y.)	254	151 034
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Navy Clothing and Textile Office, Brooklyn, N. Y. This name has been changed to Naval Supply Research and Development Facility, Bayonne, N. J.		
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Northrop Aircraft, Inc. Hawthorne, Calif.	41	135 666
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Northwestern U., Evanston, Ill.	102	135 370
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Perkin-Elmer Corp., Norwalk, Conn.	228	151 031
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